ol. XXIV, No. 4

MAY, 1957

THE SCIENCE TEACHER

JOURNAL OF THE NATIONAL SCIENCE TEACHERS ASSOCIATION

THE SCIENCE TEACHER

Vol. XXIV, No. 4 **May, 1957**

Articles published in THE SCIENCE TEACHER are the expressions of the writers. They are not a statement of policy of the Association or the Magazine Advisory Board.

The National Science Teachers Association is a department of the National Education Association and an affiliate of the American Association for the Advancement of Science. Established in 1895 as the NEA Department of Science Instruction and later expanded as the American Council of Science Teachers, it merged with the American Science Teachers Association and reorganized in 1944 to form the present Association.

THE SCIENCE TEACHER

The Journal of the National Science Teachers Association, published by the Association, 1201 Sixteenth Street, N. W., Washington 6, D. C. Membership dues, including publications and services, $4 regular; $6 sustaining; $2 student (of each, $1.50 is for Journal subscription). Single copies, 50¢. Published in February, March, April, May, September, October, November, and December. Editorial and Executive Offices, 1201 Sixteenth Street, N. W., Washington 6, D. C. Copyright, 1957 by the National Science Teachers Association. Entered as second-class matter at the Post Office at Washington, D. C., under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in the Act of February 28, 1925, embodied in paragraph (d), Section 34.40 P. L. & R. of 1948. Printing and typography by Judd & Detweiler, Inc., Washington, D. C.

MEMBERSHIP

The membership year coincides with the calendar year. New entries during the fall months extend through the following calendar year. Library and elementary school subscriptions coincide with the school year or run for one year from date of entry.

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REMINDER TO *TST* READERS AND SUBSCRIBERS

This issue of *The Science Teacher* concludes the spring series. The next issue will appear in September. It and succeeding fall issues will feature stimulating articles—but ideas are also wanted from *TST's* readers (see the adjoining Editor's Column).

Editor's Column

The close of the school year and halfway through the publication schedule of Volume XXIV of *TST* seems like a good time to wonder, "How are we doing?"

You, the readers, are in the best position to give good answers and sound advice.

We wonder, for example, which articles you would vote the 1-2-3 best of the current school year? We haven't developed or published a "symposium" this year. Have you missed this kind of item? If so, what topics would you suggest?

How about our balance of articles among the various areas of science—biology, chemistry, earth science, physics, etc.? And between elementary, secondary, and college levels?

Cover pictures are sometimes a problem for us. Which one or two did you like best? Least? Any offerings?

Are we running too much or too little of: NSTA activities, FSAF activities, audio-visual reviews, affiliated groups reports, letters to the editor, and such like. We worry and bite our nails trying to do a better job with the *hundreds* of books we receive for review. How would you like to see this problem handled?

Those "reports to the profession" by our FSAF summer conference groups—have they been useful? How do you use them? We have three such conferences coming up this summer and therefore three more reports to look forward to during 1957-58. How can they be improved to give you more realistic help?

Our NSTA journal is the leader in its field in circulation and readership. But we can't be complacent and assume that *ergo* it is also the leader in quality. We think it's pretty darn good and we're striving to make it better. It's your journal, though, not the editors' and you can help make *TST* the superior product it should be. Let us know what authors you'd like to read again, or for the first time, in our pages. When you hear a good talk or presentation, encourage the author to send us a manuscript. And don't you have something yourself to contribute—a classroom idea, a carefully thought-out treatment of a problem in science teaching—or a rebuttal to someone else's ideas?

Production and circulation of 12,000 copies per issue of *TST* now require nearly full time of two NSTA staff persons. *TST* costs about $3000 an issue and carries its editorial content, advertising messages, and other information to more than 20,000 readers. Editors, contributors, and readers all share the responsibility of making such expenditure of effort, time, and money yield the highest possible returns in relation to professional service.

Why not take 20-30 minutes out of your busy life and react to *several of the above queries?* The editors and the Magazine Advisory Board would love to hear from you. Meanwhile, best wishes for a pleasant and profitable summer.

Robert H. Carleton

One very serious moment, please . . .

With JOHN A. BENNETT

Chief, Mechanical Metallurgy, National Bureau of Standards, U. S. Department of Commerce, Washington, D. C.

I JUST RECENTLY SERVED as a judge for the National Metals Awards in the FSAF Science Achievement Awards for Students. In reading the projects submitted, I was disturbed to note that several of the students were conducting experiments that might have caused serious injury, yet were apparently unaware of the dangers involved. One report mentioned an explosion involving nitric acid and a number of others told of using potentially explosive or violently reactive materials with few if any safeguards. Other contestants had evidently exposed themselves to poisonous vapors, particularly mercury and CCl_4.

When one considers that I read only a fraction of the entries in this one program, it seems that this and the large number of science fairs, etc., throughout the country provide a very serious potential hazard.

Discussing these thoughts with some of my colleagues, I heard at least one firsthand report of an injury in connection with a science project. Such accidents, it seems to me, have a damaging influence on the whole program to encourage science talent.

I realize the responsibility for cautioning the students about possible hazards should be taken by the instructor or sponsor. Nevertheless, certain steps could be taken to improve the situation. For example, since the NSTA student publication, *Tomorrow's Scientists,* has a wide student readership, would it not be a good idea to include articles on some of the common laboratory hazards? Secondly, in the material sent to entrants in the FSAF program, why not include a requirement that, when a project involves experimental work, the possible dangers must be discussed with the instructor before the work starts? Make it clear that failure to report on important hazards will be considered grounds for disqualifying an entry.

I believe this subject is going to be of increasing importance and should be considered carefully by any group sponsoring student science activities.

THIS MONTH'S COVER . . .

symbolizes one of the great events in the history of mankind—the International Geophysical Year, an 18-month "year" which will be inaugurated July 1, 1957. The cover shows an artist's conception of the satellite which will be revolving in the ionosphere. Sensational as the satellite story is, it is only one part of what will be going on during IGY. There will be many seemingly routine tasks being carried out throughout the world, all designed to help man learn more about his universe.

For details of what will be going on during IGY, read the article by Hugh Odishaw, executive director of the U. S. National Committee for the IGY, which begins on page 166 of this issue. The editors of *TST* consider this the definitive article on IGY and are proud that it was written especially for *The Science Teacher*.

This issue features the IGY story, of course, but there are other important items. For example, there is the list of the 1957 winners in the program of FSAF Science Achievement Awards for Students. It's in two separate "parts" in *TST* this year: a double-page picture spread on pages 174 and 175 and the list of winners beginning on page 185. These winners are too young, of course, to be taking a leading part in the work to be done during IGY. But it's a pretty sure bet that quite a few of them, in the years to come, will be doing scientific work which will help to expand the knowledge the IGY scientists will unearth.

Readers' Column

The report on high school science teaching *(On The Target!)* in the April issue of *TST* is the most sensible one I've ever read on this problem.

I have been much concerned of late because all of the stress and money and attention are going to science subject matter activities to the neglect or exclusion of the teaching phase of the problem. As one result, teachers leave the profession to become scientists, thereby further increasing the shortage of science teachers. Who is robbing whom? Science is killing the goose that lays the golden eggs!

The job is science *and* teaching. Science teachers are not 20-gallon tanks into which quantities of science facts and concepts are poured so that students can drain off a pint occasionally. We must do much more to increase the *human* and *professional* teaching phase of this activity—and this means *education* as well as science.

A Florida Teacher

Thanks for sending us the brochure, *On The Target!* Superb! Bulls-eye! Please send us 1000 copies.

B. F. Kingsbury
Executive Secretary
Educational Council of
The Massachusetts Institue of Technology
Cambridge, Massachusetts

Thank you very much for the very interesting leaflet *(On The Target!)* on high school science teaching. I shall not venture any comments except to say that it sheds a welcome light on an area which has been covered by darkness and confusion.

The leaflet's arrival is especially timely because I am soon to talk briefly to a P.T.A. in a nearby town, and I shall take the liberty of availing myself of some of the facts which the leaflet so clearly sets forth. I am sure it will make an effective presentation.

Charles H. Chatfield
Secretary
United Aircraft Corporation
East Hartford, Connecticut

In the Editor's Column in the December 1956 issue, you asked whether we readers agree on the need for spending a few thousand dollars "in research, fact-finding studies, and conferences dealing with curriculum and instructional methods in science." I answer with a very positive YES.

I think that tens of thousands at this time should be spent on curriculum and methods studies. From my own education and experience, I know that the usual college and university education courses are so tied up with credits, etc., that there is not sufficient informality allowed for expressing oneself if one belongs to the experienced category.

O. Edwin Burkhart
Sacramento, California

I'd like to take this opportunity to compliment you on the fine character of *The Science Teacher*. Like many others, I find much stimulating and valuable information in its pages.

Peter Hang Gong Hua
Oregon State College
Corvallis, Oregon

You may be familiar with the weekly program, *Mr. Wizard,* televised here at 12:30 p.m. on Sundays. In general, he does a good job in demonstrating elementary science. However, on Sunday, March 3, his topic was force, work, and power. And he was badly mixed up. His ignorance of the topic was appalling. It is shocking that such a program could be presented to a nation-wide audience of millions.

Along the same line, you may have noticed in a recently published high school physics textbook that a table of horsepower has the victims running a 100-yard dash *vertically* in ten seconds! Should there not be some authoritative review of such "science" presentations to assure accuracy?

George Tracy
Polytechnic High School
Long Beach, California

I find that *The Science Teacher* is very helpful to me as a biology teacher in senior high school and I would therefore like to become a member of the Association.

Martha M. Allen
Nashville, Tennessee

Last fall when I joined NSTA, not being familiar with your services, I specified sustaining membership. However, your services have been so good that I want to change to a life membership and am enclosing my check for the additional $4 for the first annual installment.

Lawrence L. Carlson
Public School
West Concord, Minn.,

Editor's Note: Strange how things sometimes come in bunches. Recently we've received three or four letters asking where copies of certain science education books can be obtained. The well-known *Curtis Digests* are in much demand. Another NSTA member is very anxious to obtain a copy of Arthur's *Lecture Demonstrations in General Chemistry*. Does any reader have copies of these or other gems in our field—copies you're willing to sell or trade? Let us know, including price, and we'll gladly serve as go-between.

THE CASE OF THE C.S.T.

By EDWARD VICTOR

Head, Science Department, Rogers High School, Newport, Rhode Island

Consider the case of Mr. C.S.T., the "converted" science teacher—a personable young man, eager and energetic, who has chosen teaching for his profession. In college he majored in social studies and minored in English.

Some time before graduation he signed a contract to teach in a small four-year high school, and was looking forward with a great deal of anticipation to his new job, his first job. He spent much of his spare time reading, planning, and preparing lesson plans for the subjects which he expected to teach.

Mr. C.S.T. Becomes a Science Teacher

Then, a few weeks before school was scheduled to open, C.S.T. received a letter from his principal. It seemed that, due to increased enrollment, two more sections of general science were necessary. All of the science teachers had full schedules and the two sections did not warrant hiring another science teacher. Therefore, in addition to teaching English and social studies, C.S.T. would have the two sections of general science.

C.S.T.'s resulting confusion was understandable. He had taken only one science course in college. The notice that he was to teach science came too late for him to enroll in a summer school for courses which would supplement his weak science background.

C.S.T. took a quick trip to visit his principal, who gave him a copy of the science textbook and teacher's manual, together with the assurance that C.S.T. would find the other science teachers most cooperative and helpful.

Slightly reassured, C.S.T. familiarized himself with as much science material as he could in the little time left him. The first day of school finally arrived and immediately C.S.T. was an extremely occupied young man. He had a full teaching load with three different preparations to make each day. In addition he was assigned a home room and had lunch room and corridor duty.

He discovered that teaching science was no easy task and that he was beset by many problems. His immediate difficulty was identifying and manipulating the apparatus. Whenever he planned to present a demonstration, he had to use a great deal of his precious time locating and assembling the equipment. Occasionally minor accidents occurred because he was unfamiliar with the precautions to be observed when handling the chemicals or equipment.

C.S.T. did not want to use all the demonstrations suggested in the teacher's manual, yet he was unable to differentiate between demonstrations—which would provide the most effective learning situations?

There were supplementary texts and reference books available. C.S.T. decided not to use them at least this year, but he had to concentrate on mastering the material in the textbook.

He noticed there were a few books on the teaching of science on the other teachers' shelves. He borrowed them and did get some idea of the aims and objectives of teaching science. However, he did not understand fully the list of principles recommended to be taught or the suggested demonstrations.

There were many pupils in C.S.T.'s science classes who were bright and seemed to have a genuine interest in science. C.S.T. knew he should try to sustain this interest with additional work and individual or group projects, but found it almost impossible to suggest other sources and avenues of work.

The Rooms Without . . .

To further complicate matters, C.S.T. discovered that his two extra science classes had created a room scheduling problem. He was unable to use the regular science classrooms and had to teach his science classes in rooms without science facilities.

C.S.T. found the other science teachers friendly enough and even quite helpful at times. However, they also were quite busy and the best they could do was to give him help "on the run." He did not have a department head to whom he could turn for help. However, C.S.T. did not know that had there been a department head, in many cases the head would have had quite a teaching load himself, in addition to the multiple administrative duties which are assigned to him.

So C.S.T. was left pretty much to his own devices for teaching science. He envied those

teachers who were enthusiastic about teaching science and deplored the fact that he was not one of them. He continued to teach science under adverse conditions and soon became discouraged. He felt that he was not doing a good job as a science teacher and it was inevitable that he gradually grew to dislike teaching science. His pupils sensed this feeling and were conscious of the mechanical manner with which C.S.T. progressed through the textbook. They, too, became apathetic and discouraged and made C.S.T. aware of this condition in no uncertain terms.

C.S.T. was in a sad state. He didn't know whether he would be assigned to teach general science again next year. If he did receive the same assignment, summer study in science would help, but he had counted on a summer job to supplement his modest salary. What bothered him even more than his own discouragement was the growing apathy of his pupils in science. This was not what he had expected when he had signed the school contract so jubilantly.

C.S.T. Needs Help

Mr. C.S.T. is no figment of the imagination. There are many C.S.T.'s in our schools today. To many this may not seem unusual, because there have always been instances where teachers have been asked to take one or more classes in subjects which were outside their fields of collegiate specialization.

Today, however, the shortage of qualified secondary school science teachers continues. The causes for this shortage are varied: increase in school enrollment, decrease in number of college graduates prepared to teach science; attractive salaries offered by both industry and government, and military service. This existing shortage of qualified science teachers implies inevitable and consistent "drafting" of teachers from other subject areas.

To complicate matters further, we are in the midst of a boom in population. A Conference on Nationwide Problems of Science Teaching in the Secondary Schools, held at Harvard University in 1953, has predicted that by 1965 our school population will double; twice as many science teachers will be needed as can be supplied.

This means "drafting" of science teachers will continue. In addition, if nothing is done to increase the supply of competent science teachers to meet the predicted demand, the number of "drafted" science teachers will multiply and possibly assume alarming proportions.

Concern about this situation and the plight of C.S.T. was the basis for a study made by the author regarding these teachers, who are teaching science either full or part time, even though it is outside their fields of collegiate specialization.

A group of 52 such teachers, known to be teaching science in the secondary schools of Massachusetts during 1954-55, were reached both by questionnaire and personal interview. An equal number of qualified science teachers served as a control.

The findings of the study substantiate what has already been said about C.S.T. It was found that the younger and less experienced teachers were being "converted" to science teaching. Ten per cent of the teachers studied had taken no courses in science whatever, and 25 per cent had taken just one or two semesters of any science. Since becoming science teachers, they had made little or no effort to study further in science.

Most of the "converted" science teachers were teaching science part time and were usually assigned to teach general science or biology. Generally they were given little advance notice of their assignment to teach science.

The "converted" science teachers used commonly accepted instructional practices in teaching science less often than the qualified science teachers. They also received less in-service training and their morale was low, almost half of them being extremely dissatisfied with teaching science.

They thought that beginning "converted" science teachers would need much help in the following areas: (1) methods of teaching science, (2) selecting and using science materials for instruction, (3) identifying and manipulating equipment, and (4) planning and organizing class work.

Be Thy Brother's Keeper

Three significant facts emerge from the study of "converted" science teachers. First, these teachers need help. Second, those who received much in-service training use the commonly accepted instructional practices in the teaching of science more often than those who received little in-service training. Finally, these teachers thought they would do a better job if persons experienced in science teaching were made available to advise and help them.

Various activities already exist for the purpose of helping employed teachers. Some of the more common ones include formal courses, workshops or committees, individual conferences and counseling, and visits to other science classes both within and outside the school.

These activities, alone or in conjunction with each other, have proven successful. However, new considerations appear when evaluating the effectiveness of these activities in terms of the characteristics and needs of C.S.T.

Formal courses can be of great value to C.S.T. Courses in subject matter would do much to supplement C.S.T.'s inadequate science background and give him some degree of proficiency in identifying and handling equipment.

Methods courses in the teaching of science, on the other hand, would provide C.S.T. with help in selecting and using science materials for instruction, planning and organizing his class work, and utilizing various techniques in teaching science.

The colleges could take cognizance of the growing number of "converted" science teachers, and offer courses especially designed to increase both the science background and teaching effectiveness of these teachers as science teachers. Further study in science, therefore, would be one means whereby C.S.T. could get help. However, what formal courses cannot provide is the immediate assistance that C.S.T. so often needs.

Workshops and committees have the added advantage of allowing C.S.T. to work on problems which tie in with local needs and requirements. They also enable C.S.T. to improve himself with a minimum of self-consciousness or embarrassment, because he is among fellow teachers who are aware of and sympathetic to his difficulties.

However, workshops also cannot provide the immediate assistance that C.S.T. needs. Workshops are organized only at periodic intervals as the need arises, when there is a common problem important enough to involve a sizeable group of teachers. Usually teachers representing many subjects or grade levels participate in the workshop, and the over-all purpose of the group would make C.S.T.'s needs only a small part of the general problem. Certainly, as a novitiate in the ranks of science teachers—and a part time novitiate at that—he might be reluctant to ask that his difficulties be given special consideration.

For his immediate problems C.S.T. needs an experienced science teacher, preferably one who is teaching or has taught the same subject. He needs a "buddy"—a brother—who will give time and effort unstintingly in helping C.S.T. prepare his lessons, learn techniques and methods of teaching science, select materials for instruction, become familiar with and adept in using science equipment, and broaden both his science background and his knowledge of objectives of science education.

"SUMMER IS ICUMEN IN . . ."

Can we keep students' science interests alive during the summer? One answer is the school gardens project developed by the Cleveland, Ohio schools. This photograph shows two youngsters taking home a harvest of vegetables from Harvey Rice School garden in Cleveland. Last summer Cleveland had six school gardens in operation, totalling about 12 acres devoted to individual pupil plots and enrolling about 2500 pupils. All work on the gardens was done under the direction of teachers trained in horticulture. The produce belongs to the pupil gardeners, and, as this photograph indicates, the youngsters take home a lot more than the food in their baskets. They also take home satisfaction, a sense of accomplishment, good work habits, gardening knowledges and skills, and healthy bodies.

This "buddy" could also recommend formal courses, supplementary reading, and suitable classes for visitation. At the same time he would be readily available for consultation and assistance.

C.S.T. would be likely to accept such advice and assistance gladly, since it came from a fellow teacher wise in the ways of science teaching. Even occasional visits by the "buddy" to C.S.T.'s science classes, followed by conferences, would be welcome.

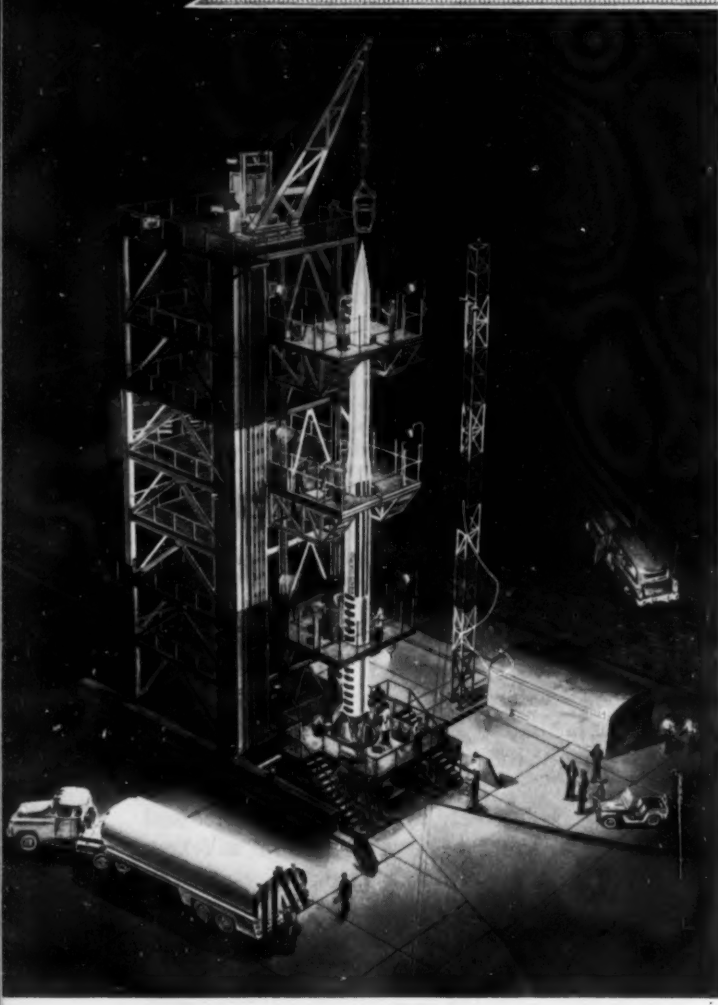
C.S.T.'s administrator has the important obligation of giving C.S.T. encouragement and assistance in this new and unfamiliar field. As an administrator he could assign an experienced person to help C.S.T., giving this person explicit responsibility and even financial rewards for this service.

"Converted" science teachers already exist in our secondary schools. Their needs are real, and their fears and anxieties are great. For the next few years at least, despite concerted efforts to relieve the shortage of competent science teachers, we are certain of having even larger numbers of "converted" science teachers in our schools. Colleges, school administrators, and qualified science teachers together can do much to increase the effectiveness of these teachers as science teachers by giving them the encouragement, help, and supervision they sorely need.

THE INTERNATIONAL GEOP

By HUGH ODISHAW

Executive Director
U. S. National Committee for the IGY



***Vanguard*, the satellite launching vehicle on which the Martin Company is prime contractor, is depicted here by a Martin artist as it will look when assembled in its giant gantry structure at Cape Canaveral, Florida. Also shown are a fuel truck, the equipment house, a cable tower, and (behind the gantry) the concrete blockhouse which is the nerve center of the launching operation.**

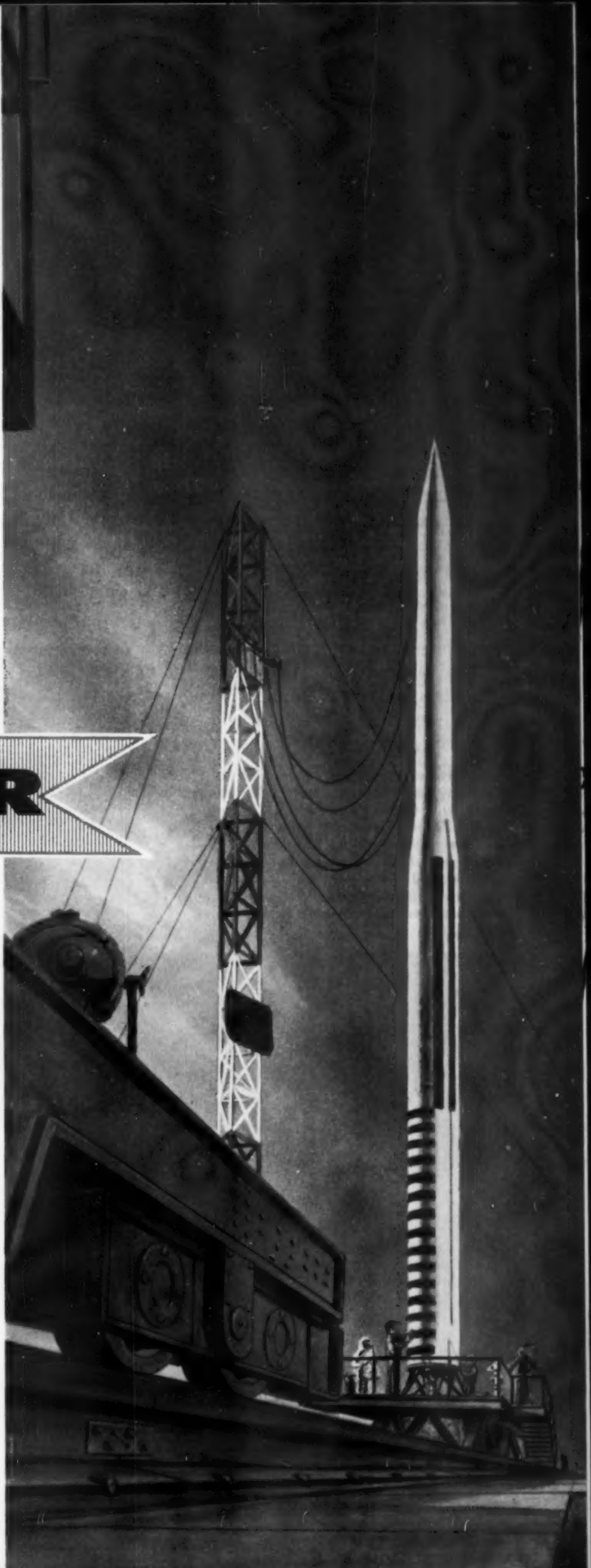
A RECENT NEWSPAPER EDITORIAL notes that scientists will be using research rockets to study the winds some 80 miles above the surface at a rocket-launching site in Canada. The editorial, perhaps facetiously, questions the utility of such an operation and wonders whether this could be considered a profitable way of spending both time and money. If winds were abstract entities, we could readily agree with the editorialist, particularly with spring and the smell of baseball in the air.

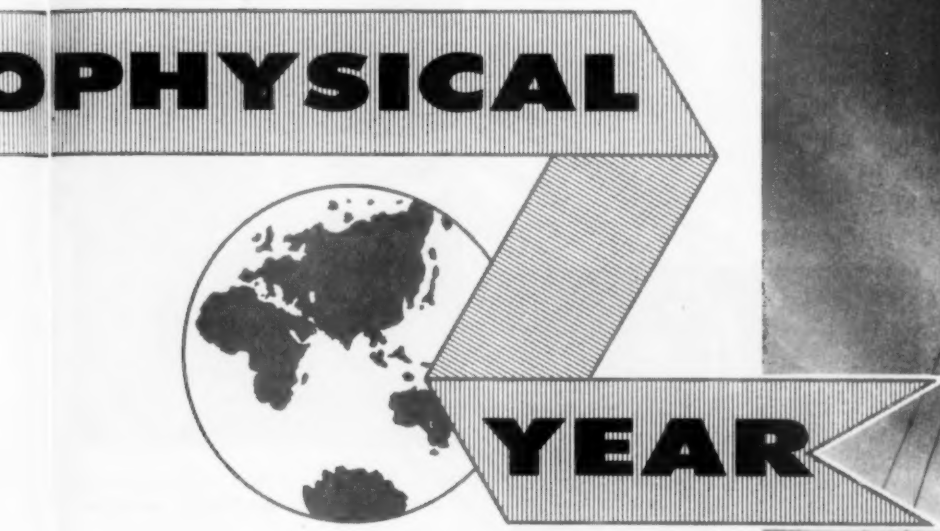
But these winds are not an abstract force. They arose somewhere in the Arctic region, swept across Canada, brought a wave of cold air to the eastern coast of the United States, and may well continue across the Atlantic, picking up moisture from the ocean on the way, and cause heavy rainfall and perhaps snow across Europe. In some regions these winds will bring necessary moisture to the earth. In other regions they may bring floods, avalanches, and death.

Major events in nature are rarely local and rarely national: ionospheric storms, the beautiful lights of the aurorae, ocean currents, and the mass movement of atmosphere do not recognize any manmade boundaries. For this reason, in part, more than 5000 scientists of some 58 nations, have joined forces for the most comprehensive and intensive study of the earth, the oceans, and the atmosphere that the world has even seen. Into the 18 months of the International Geophysical Year (IGY) will be compressed more than a score of years of normal research as the world's geophysicists attempt to get a unified picture of our physical environment.

During the IGY, scientists will explore almost every major land and sea area. They will study

When the rocket—as tall as a seven story building—is ready for fueling, the hinged gantry platforms are swung clear and the whole assembly rolls back along tracks.





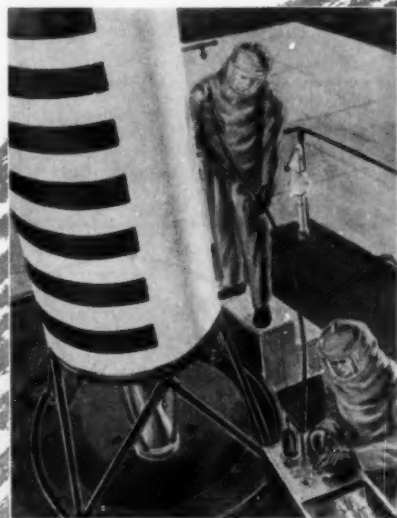
the earth's core and crust. They will probe into its interior with explosion sound waves, and send rockets and satellites to explore the high atmosphere and outer space. They will measure the deep ocean currents and the surging tides in the seas. They will observe and measure the many mysterious particles that continually bombard the earth from outer space.

The countries formally participating in the IGY are: Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Ceylon, Chile, the Chinese Peoples Republic, Colombia, and Cuba. Also Czechoslovakia, Denmark, Dominican Republic, Ecuador, Egypt, Ethiopia, Finland, France, East and West Germany, Great Britain, Greece, Guatemala, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Mexico, Morocco, Netherlands, New Zealand, Norway, Pakistan, Panama, Peru, the Philippines, Poland, Portugal, Rhodesia and Nyasaland, Rumania, Spain, Sweden, Switzerland, Tunisia, the Union

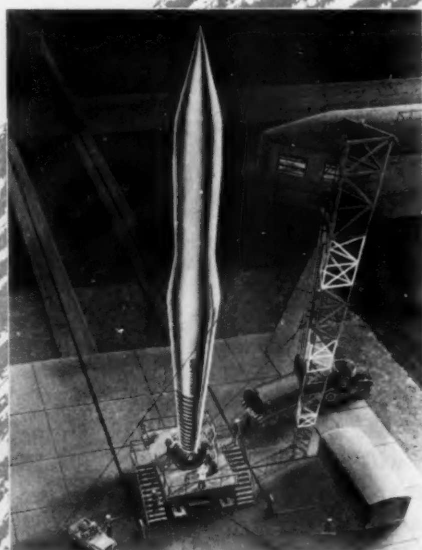
of South Africa, the USSR, the United States, Uruguay, Venezuela, and Yugoslavia.

Others are expected to join us and still more will cooperate in a number of experiments. Each participating country has set up a national committee to design its own program in accordance with certain general criteria. To coordinate the various national programs, to avoid needless duplication of effort, and to see that no significant area or discipline is not adequately covered, an international committee has been set up (Comité Special de l'Annee Geophysique Internationale).

The program of the United States has been planned by the nation's leading geophysicists, gathered together by the National Academy of Sciences. This program includes projects in the 13 disciplines and areas of activity involved in the IGY: aurora and airglow, cosmic rays, geomagnetism, glaciology, gravity, the ionosphere, longitude and latitude determinations, meteorology, oceanography, seismology, solar activity, rocket and satellite studies of the upper atmosphere, and world days and communications. The U. S. program will include activity within the continental limits of the United States, Alaska, the Antarctic, the Arctic Basin, the equatorial Pacific, the waters of the Atlantic, the Pacific, and the Indian Oceans, and various cooperative efforts with nations of North and South America.

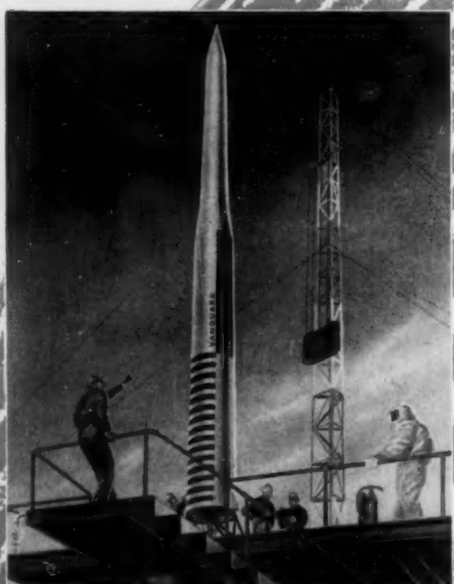


Here is a close-up of the fueling operation.



Fueling the vehicle is a delicate task. Several of the liquids used in *Vanguard* are corrosive or inflammable; and the men who actually carry out the task are dressed in protective clothing and equipped with firefighting apparatus.

This view of *Vanguard* emphasizes its similarity in appearance to a giant bullet. *Vanguard*, whose "payload" will be a 20-inch sphere crammed with scientific instrumentation, will be the fastest-moving object ever built by man. To enter an orbit around the world, the satellite will have to attain a velocity roughly ten times as great as that of a high-powered rifle bullet.



For the planning and execution of the program, the National Academy of Sciences established the U. S. National Committee for the International Geophysical Year. This committee, in turn, set up technical panels of experts in each of the fields to be studied. These experts designed the U. S. program, with the National Committee reviewing and coordinating the whole. Dozens of private and governmental institutions are participating in the program; the U. S. Congress has provided the committee special funds for much of the work through the National Science Foundation.

Spotlighted against the backdrop of a starry sky, the satellite launching vehicle rises from the firing stand.

The 72-foot, 11-ton rocket vehicle begins its trip into space.

Once the fuel in the first stage is expended, the entire stage drops off into the Atlantic Ocean to reduce weight during the rest of the flight.

The IGY program will be carried out largely during the 18-month period beginning July 1, 1957 and ending December 31, 1958. There are several reasons why this particular period was chosen. The most important reason is nature itself: solar activity increases and decreases fairly regularly on an 11-year cycle; the 18-month, 1957-1958 period of the IGY is a period of expected maximum solar activity within the current cycle.

Another reason is the recent advances made in electronics instrumentation. Within the past several decades, instruments of vastly improved precision have been developed, permitting an accuracy of measurements that was never before possible. And the development within the past ten years of high-speed electronic computers will make possible the collection and collation of the quantities of data that characterize many fields of geophysics.

The third reason is that research in the earth sciences has reached a point where a concentrated world-wide effort is most promising for both immediate and long-range benefits.

The International Geophysical Year is unique in scope and depth but it is not without precedent. In 1882-83 the First International Polar Year was held, and in 1932-33 there was a Second International Polar Year. Both of these cooperative efforts were largely limited to the Arctic regions and depended on the work of relatively few scientists of a small group of nations. But the pioneering investigations during these earlier "Years" in such fields as the aurora, ionospheric physics, geomagnetism, and meteorology provided extremely valuable data and indicated the advantages to mankind of a world-wide effort such as we are now undertaking.

Our fields of study can be divided into three broad groups: In the upper atmosphere we are interested in the radiations and particles that cause the aurora and airglow, unusual conditions in the ionosphere that may result in radio fadeout, the sudden rapid changes in the earth's magnetic field, and in cosmic rays; in all of these studies the sun plays a dominant role, and unusual solar activity will be closely examined. Closer to earth are the studies of the earth's heat and water budget, the continuous exchange between the world's ice, water, and atmosphere that are related to the circulation of the atmosphere; and which, thereby, in a large measure determine our weather. The third group of studies concern the earth itself and its interior; in this group, we are concerned with seismology, gravity, and latitude and longitude determinations.

Man's life on earth is to a large extent controlled by weather; the clothes he wears, his shelter, his means of transportation, even the food he eats are all related to weather. The knowledge of weather and, over a longer period of time, of climate, become increasingly important with every advance in civilization.

In the study of weather, the large- and small-scale circulation systems in the atmosphere must be considered on a world-wide basis. Through the simultaneous study of meteorology, glaciology, and oceanography, geophysicists hope to learn more about the world's weather and thus be able to improve their forecasts, particularly over longer periods of time.

The IGY program in meteorology, both in the northern and southern hemispheres, will study the mass movement of air between the tropics and the polar regions and the circulation of the atmosphere around our planet. Chains of stations through the world will launch balloon-borne weather instru-

ments up to heights of 100,000 feet to obtain information on pressure, temperature, humidity, and winds. With this information, meteorologists can better see the true three-dimensional character of the atmosphere which is needed to increase our knowledge of basic weather patterns as well as to improve long-range weather forecasts.

In the Antarctic, the United States has established a Weather Central at the Little America base which receives meterological data from the approximately 60 Antarctic stations and prepares twice-daily consolidated Antarctic weather reports for the first time in history.

The effects of ocean surface currents on weather are well-known but we have only begun to learn about ocean currents below the surface. Surface currents are largely caused by wind, the earth's rotation giving them an extra twist—called the "Coriolis Effect." Undersea topography also affects the deep ocean currents. The movement of deep water, however, is primarly a matter of density differences; surface water is cooled in high latitudes, increasing its density so that it sinks and tends to displace the less dense water; as this process continues, the deep water in the polar regions flows toward the equator, and deep-water currents are set up.

There are several other reasons for studying deep currents in addition to their importance to long-range weather forecasting. First, ocean fertility depends upon the exchange of water between the deeps and the surface; the amount of fish and other foods we can take from the sea is limited by the rate at which the ocean overturns and resupplies the surface with chemical nutrients from the deep waters. Second, the peaceful uses of atomic energy are expected to produce enormous quantities of radioactive wastes. We must learn more about the ocean deeps to determine whether it is safe merely to dump these radioactive wastes into the ocean without regard to the consequences.

The Ice and Snow Budget

The world's supply of ice and snow is another factor in the earth's total water and heat budget. Glaciers are found on all continents except Australia; they are found even in the tropics at high altitudes.

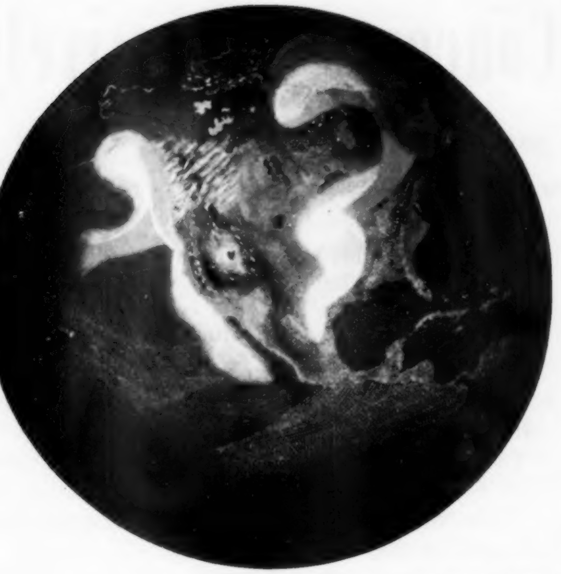
The U. S.-IGY program in glaciology includes detailed examinations of selected glaciers in the United States and Alaska and a comprehensive program in the Antarctic, as well as studies of the sea-ice in the Arctic Ocean. These studies will attempt to determine the world's ice supply so that future observations will show whether it is growing or shrinking.

Gravity measurements are fundamental in importance to a knowledge of the size and shape of the earth and the distribution of matter in the solid crust of the earth. Because of the practical value in mapping and in the exploration for minerals and petroleum, many local surveys of gravity have been made; these may also be useful in local geodetic surveys. But there still remain many gaps, particularly in the Arctic and Antarctic regions, in the world gravity network. The IGY gravity program seeks to complete, as far as possible, global coverage. Advantage will be taken of the occupation of remote areas and of supply trips to such areas to make gravity measurements where none have been made before, and the various separate gravity networks, largely national, will be interconnected to establish a first-order international network.

Related to these studies is the IGY program in seismology. Of prime importance in seismology is the study of earthquakes and their consequences. Seismology has provided answers with some degree of success in outlying regional and local areas that are most vulnerable to earthquake damage, determining the optimum construction to minimize earthquake damage to structures.

Seismological studies have long been conducted on an internationally cooperative basis, and there is now a network of about 300 standard seismograph "listening" stations over the world, with many additional specialized types of equipment located in areas of frequent earthquakes. During the IGY, there will be an increase in the number of seismographic stations throughout the world, with emphasis on such vast areas as the Pacific Ocean, the Antarctic Continent, and the Atlantic Ocean basin where such installations are scarce or nonexistent. An increase in the number of seismographic stations will contribute much needed information for a detailed study of earthquakes as well as an increased knowledge of the earth's crust and interior formation.

Even today man does not know the precise position of certain islands or even how far apart the continents are. Some islands may be as much as a mile from where we think they are. Some 20 IGY stations around the world will make observations for a more exact determination of longitude and latitude. A new method of determining latitude and longitude is through the moon position camera, a camera which photographs the moon in relation to the surrounding stars—the moon is held



HARRY WEXLER, U. S. WEATHER BUREAU

This is a portrayal of features of the earth's surface and hypothetical cloud systems as they might appear on a black and white TV picture taken from a satellite 4000 miles above Amarillo, Texas.

fixed while the stars are photographed. Several observations by a station on a single night will accurately determine the position of that station with reference to the center of the earth.

Many geophysical phenomena of fundamental importance occur in the high atmosphere of the earth. The fields of geomagnetism, aurora, ionospheric physics, and cosmic ray research are all directly related to the events which occur at heights higher than 50 miles above the earth.

Over-all solar activity, as mentioned earlier, is measured by the 11-year sunspot cycle. Many other solar phenomena, such as enormous flares, prominences, and other types of active regions vary according to the same time scale. Since 1957-58 will be a period of maximum solar activity, IGY scientists will develop detailed and comprehensive records in this field by means of systematic observations of the sun through improved and faster coordination of the observing programs of solar observatories. Solar activity will be observed both in the visible spectrum and at radio frequencies. In particular, solar flares will be studied and correlated with changes in cosmic rays, ionospheric and auroral disturbances, and geomagnetic storms.

During the IGY, a spectroscopic observation program will give the distribution, both geographically and with respect to time during the auroral display, of radiations of the auroral spectrum. The visual and photographic observations of the aurora have as objectives the creation of synoptic maps showing aurora distributions at small time intervals and the collection of data for statistical studies of aurora with other geophysical phenomena and with solar phenomena. With modern techniques such as the all-sky camera, the IGY scientists will fill the gaps in knowledge about the aurora borealis in the Arctic, gather data heretofore unavailable about the aurora australis in the Antarctic, and trace the relationship between the two. Measurements of the intensity of airglow radiations will be made with photo-electric instruments of high sensitivity. The observing stations will be distributed along a longitudinal chain reaching from the Arctic to the Antarctic.

The existence of cosmic rays has been known for 50 years, but where they come from and their precise nature remain uncertain. The magnetic field of the earth is the chief instrument for analyzing the energy of cosmic rays. Cosmic rays are bent in this field in such a way that low-energy rays cannot arrive at equatorial latitudes but tend to come in chiefly near the magnetic poles; high energy components arrive at all latitudes. During the IGY, scientists expect to gain knowledge of the reasons for the large decreases of cosmic ray intensity during some magnetic storms, fluctuations in cosmic ray intensity near sunspot maximum, the world-wide variation of cosmic ray intensity with the sunspot cycle, and sudden large increases of cosmic ray intensity within an hour or less after the beginning of solar flares or chromospheric eruptions.

The U. S.-IGY geomagnetic program consists of a series of experiments mainly designed to yield facts about the rapid magnetic field fluctuations which are usually accompanied by disturbances in radio wave propagation and often by auroral displays and which also increase in number and intensity with an increase in the number of sunspots.

The ionosphere is studied chiefly by means of the radio waves which it reflects. IGY scientists will take vertical incidence soundings at a number of sites in the United States and oblique incidence soundings both in the United States and in the Pacific area. There will be measurements in sporadic-E, back scatter by sweep and fixed frequency techniques, and experiments in forward scatter. Radio noise and ionospheric absorption will also be measured and there will be an extensive network of stations to study "whistlers."

Until recently, studies of the upper atmosphere have been seriously handicapped because direct

(Please turn to page 194.)

Developing Science Concepts Inductively

By MELVIN HETLAND

Supervisor, High School Education, Long Beach, California, Public Schools

OFTEN SCIENCE CONCEPTS are not developed. Rather they are presented and explained by the teacher. While such instruction can be effective, it depends in the final analysis upon authoritarian rather than authoritative principles; i.e., the acceptance of the concept by students tends to be unduly dependent upon the authority figure of the teacher or the textbook and not the experiences of the students themselves. Also it places a great amount of stress upon the ability of a teacher to command interest rather than to arouse it. Another essential difficulty is that this method starts with a solution rather than a problem and is for that reason a weak motivating procedure. Further, it almost completely ignores the scientific method in the development of concepts of science.

Proceeding from the Known to the Problem

The inductive method proceeds from the known and observable—i.e., known and observed in the experiences of students—to the problem and depends upon broadening this experience to the end that the students themselves discover the solution to the problem.

As an example, let's take a common concept of science and see how it could be developed inductively with students. The concept that evaporation produces cooling and that the rate of evaporation is dependent upon humidity and the volatility of the substance evaporating will serve to illustrate the method. To be sure, this concept can be broadened to include temperature and pressure but for purposes of illustration we will deal with the concept in limited form.

The teacher will make the following preparations:

1. Place a beaker of water and a beaker of alcohol in the room the night before to permit both to reach room temperature.
2. Set up five thermometers,
   a. one surrounded only by air;
   b. one immersed in the beaker of water and one in the beaker of alcohol; and
   c. one wrapped with a cloth, the other end of which is immersed in the beaker of water, and another with a similar arrangement with the alcohol beaker.
3. Have available a dozen medicine droppers and two watch glasses.

Questioning to Help Students Observe

The teacher says to the class, "Will each of you hold one of your hands straight out from your body? Is anything touching your hand?"

The likely responses are, "Nothing!" And then, "Air."

"How would you describe the feeling of temperature on your hand?"

The responses will probably be, "Warm," "Comfortable," "Moderate," and so forth.

"Where does your hand get its sensation of temperature?"

"From the air touching it."

Providing Opportunities for Additional Experience

The teacher may now ask, "Roy, will you read these three thermometers—the one surrounded by air, the one in the beaker of water, and the one in the beaker of alcohol?" As Roy reads the thermometers, the teacher records the readings on the board under appropriate labels and calls the students' attention to the fact that all three readings are the same.

The teacher then says, "Now we are going to take some water from this beaker in which one thermometer is suspended and place a drop on the hand of each one of you." To speed up the procedure the teacher may find it good to have four or five students assist.

After this has been done, he asks, "Does the water feel colder than, warmer than, or the same as the air?" The response will be that it feels colder.

"Next we are going to place a drop of alcohol on each of your hands."

"How does it feel as compared with water and air?" Again the responses will be that the alcohol feels colder than either air or water.

Motivating and Guiding Through Further Questioning

The teacher continues, "Why these differences? Can anyone explain them?" The teacher should

listen to all explanations, confirming or rejecting none, for to do so will deny many of the students the rich experience of discovering the reasons for themselves.

Someone will likely suggest that the reason alcohol feels colder is that it evaporates faster. The teacher might ask, "How could we check to find out which evaporates faster? Could we put a drop of water on one watch glass and a drop of alcohol on another and see which evaporates first? George, will you watch and see what happens? And report your findings to us."

The teacher goes on, "Here we have two more thermometers. Each has a piece of cloth wrapped around it. This cloth is dipping into the water and this one into the alcohol. Mary, will you touch each piece of cloth and tell us if each feels moist or dry?"

Mary will respond that both feel moist.

"Now, Mary, will you read these two thermometers while I record the readings on the board?"

Mary will find that the thermometer with the wick in water has a lower temperature reading than the thermometer in air and that the thermometer with the alcohol wick has a lower reading than either of the other two.

Helping Students Recall Previous Common Experiences

"Let me ask you another question. When are you most aware that your body is perspiring? On humid (moist) summer days or on dry summer days?"

We know the response will be, "On humid summer days."

"How about on a calm day or a windy day?"

And the response will be, "On a calm day."

"A couple more questions if I may. What could you do to water to cause it to change to water vapor (steam)?"

And the response will be to heat it.

"Does this mean that if water takes on enough heat it will change to water vapor?"

Summarizing with Questions

The teacher may now say, "Let's check our observations. First, did we decide that the air surrounding our hands produced the sensation of temperature? Did we also observe that the thermometer surrounded only by air as well as those immersed in water and alcohol all had the same temperature readings? Then did we find that a drop of water of the same temperature as air felt colder on our hands than did air?

"And, George, which evaporated faster, the drop of water or the drop of alcohol?"

George will report that the alcohol evaporated faster.

Focusing on the Problems

"Considering all of our observations and our discussion, what questions do you have about these observations?" The students will likely be eager to frame questions and the teacher should feel free to do so too, writing each question on the board as it is raised. These might be typical:

1. Why does a drop of water of the same temperature as air feel colder on our hands than the air? And why does a drop of alcohol feel colder still?
2. How come the thermometers immersed in the beakers had the same reading as the air thermometer, but those wrapped with wicks wet with water or alcohol had lower readings?
3. Why did the alcohol-wick thermometer have a lower reading than the water-wick thermometer?
4. Why are we more aware of perspiration on humid summer days than on dry summer days, or on calm days than on windy days?

Encouraging Reading for Information

Following the listing of these questions, the students may be encouraged to try answering them. Again the teacher should listen, question, recall observations but not confirm or deny the generalizations presented. Rather he may now direct the students to their textbooks to seek further information and encourage them to continued reflective thought as a result of their reading in relation to the observations and the questions raised. He is likely to be pleasantly surprised on the next day to find that the vast majority of the students have found the answers they seek and know that their reasoning is correct. For those who still have not discovered the generalizations, the teacher can state the generalization in the form of a question and ask if it seems reasonable in light of their observations of yesterday and their subsequent reading.

Expanding and Applying the Concept

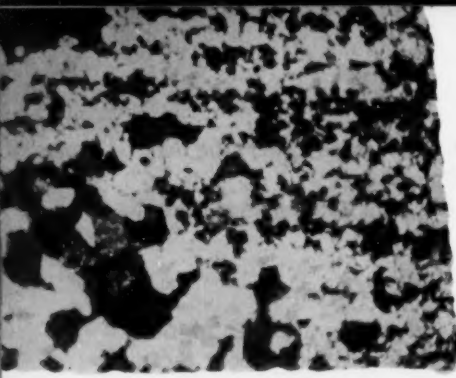
This may seem like a time-consuming procedure to develop a concept but let us see what else can happen as a result of this experience. First such related concepts as these have been partially developed and can be completed in less time:

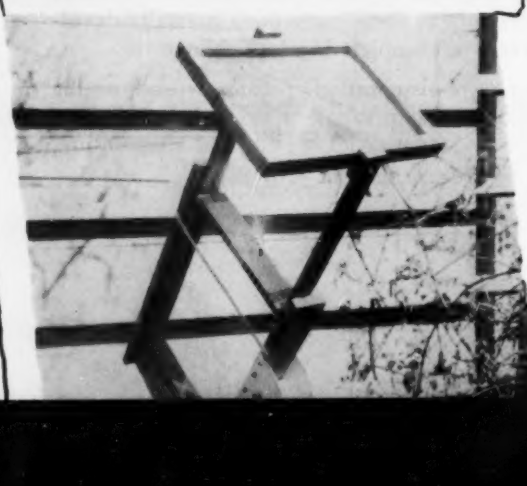
1. The rate of evaporation of water depends on the amount of water vapor in the air as compared to the amount it could hold at that temperature.

(Please turn to page 200.)

1957 WINNERS

SCIENCE AC
AWARDS FOR





THE PHOTOGRAPHS ON THESE TWO PAGES—a mere handful from the hundreds that were submitted—give a clue to the variety and scope of the entries this year in the program of Science Achievement Awards for Students. Sponsored by the American Society for Metals and conducted by the Future Scientists of America Foundation of the National Science Teachers Association, this was the sixth annual program and it hit a record high in student participation.

There was a total of 2941 entries received from students throughout the United States and from Canada. As specified by the pattern of the program, the entries were submitted to judges in eight geographic regions in the United States. In each region, 15 entries were selected as winners: five 7th and 8th grade students received $25 U. S. Savings Bonds; five 9th and 10th grade students received $50 U. S. Savings Bonds; and five 11th and 12th grade students received $75 U. S. Savings Bonds.

In addition to these 120 regional winners, 20 students received National Metals Awards for projects dealing with metals and metallurgy. These

Photomicrograph showing the structure of an annealed test sample from Murray Engle's (Tulsa, Oklahoma) project, "A Metallurgical Study and Examination of Carbon Steel", which won him one of the National Metals Awards

Margaret Reynolds (Indianapolis, Indiana) locates thyroid glands in her chicks project

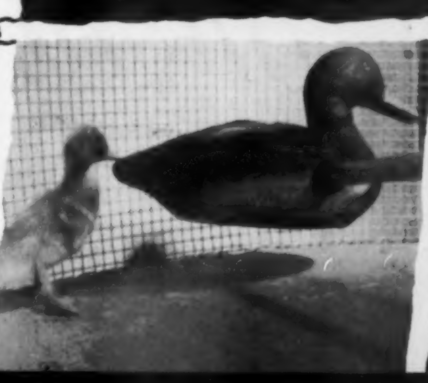
Close-up of a raccoon from David Hamlin's (Trumbull, Connecticut) "Photography in Nature"

David Ecklein's (Cedar Falls, Iowa) oscilloscope for his project, "The Use of Sound for the Measure of Distance"

Solar furnace used by Brian Calahan (Mill Valley, California) in "Extracting Metals by Solar Energy"

ACHIEVEMENT

OR STUDENTS



awards were $100 U. S. Savings Bonds to each winner. The metals and metallurgy projects were judged on a national basis after having been considered for regional awards.

All of the winners of bonds also won FSA gold lapel pins and FSA certificates. Their schools received FSA trophy case plaques engraved with the names of the winning students.

Honorable Mention certificates were awarded to 1186 entrants. As in previous years, the regional judges found that more than 40 per cent of the student entries merited Honorable Mention certificates.

Guidance in planning and effectively carrying out the program along the lines desired by teachers and scientists was given by an Advisory Committee. Its members were: Glenn O. Blough, associate professor of education, University of Maryland, College Park, and NSTA president-elect; Mrs. Anita Bickford, Leland Junior High School, Chevy Chase, Maryland; N. C. Fick, Office of Defense Mobilization, Washington, D. C.; Edward M. North, Washington and Lee High School, Arlington, Virginia; and Madeleine T. Skirven, Eastern High School, Baltimore, Maryland.

As a stimulant to the development of future scientists, the SAA program continues to prove most effective. For its support of the program, the American Society for Metals is due the thanks of students, scientists, industry, and science teachers.

The photographs on these pages are from award-winning projects. For a complete list of winners, see page 185.

Loft which was "home base" for the experiments in Jean Ann Appleton's (Hyattsville, Maryland) "Pigeon Navigation and Orientation"

Telescope-camera combination for Frank Vittor's (El Cajon, California) research in "Astronomical Photography with Homemade Instruments"

Arthur Imig (Sheboygan, Wisconsin) adjusts his model in his project, "Construction of a Coronagraph"

Inoculation process in Morris Weller's (Abilene, Texas) "Relationship of Plant Tumors and Animal Cancer"

Photograph by David Fuller (Atlanta, Georgia) utilizing a new type of wide-angle lens developed in his project

Experiment from Richard Milner's (New York City) study in "Releasing the Following-Response in White Pekin Ducklings"

Adventures in Bird Ecology

By DANIEL F. JACKSON

Department of Biology, Western Michigan University, Kalamazoo

This article is Contribution No. 7 from the Department of Biology, Western Michigan University.

MAN has found bird watching fascinating ever since the primitive cave dweller peered out at the migrating ducks in the dim dawn. From that time until now, millions of bird watchers, of all ages and every description, have obtained pleasure and relaxation from this pastime. Nevertheless, most people lose much of the joy which they might derive from bird watching, simply because they have no design for their observations. A little careful planning would provide not only more enjoyment but information of real value to scientific bird study.

The type of observation which I recommend falls in the realm of bird ecology. And what comprises *ecology?* In essence, it is the interrelationship between an organism and its environment. The chief aim of the study of ecology is to understand these interactions under natural conditions. Now, all of us are aware of how important it is to observe birds under natural conditions. We do not get up at 4 a.m. to watch the courting behavior of a robin caged in a nearby zoo. Nor do we remain entirely satisfied with the vicarious experience of listening to bird songs on recordings. Instead, we go out to meet the birds, making notes of what we see and hear of their life and loves.

Some of us, however, may be faced with an embarrassment of riches in choosing the truly significant. After we have flushed and identified the bird, what next? Although complete outlines for ecological life history studies are available concerning a variety of species, from vascular epiphytic plants to solitary and semi-social bees, no comparable guides have been developed to aid the ornithologist. The accompanying diagram has been constructed with the hope that it may enrich bird watchers' observations in the exploration of bird ecology.

The major ecological divisions are shown in the form of a clock because each is mutually and equally significant. It will be noted that the arrangement is in ascending order clockwise in relation to the usual amount of time devoted by the average bird watcher. As a demonstration of how best to use our ecological clock, let us select a bird and follow its habits accordingly. For example, we will choose the ruffed grouse. On a field trip, this is an easy bird to identify by the characteristic fan-shaped tail. It is usually after this identification that most bird watchers stop. But we are gleefully going further: not only shall we identify just this bird, but we shall attempt to discover what other bird life makes up his environment and therefore affects it.

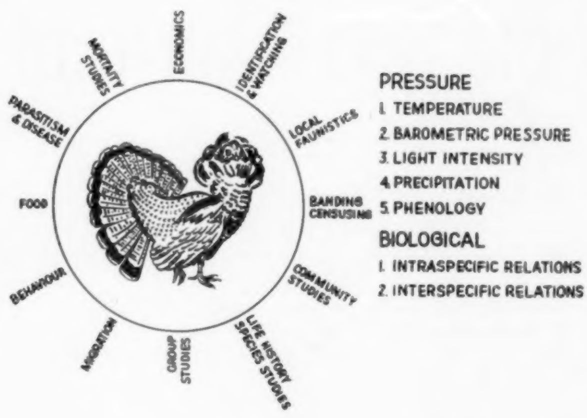
Possibly we will go so far as to band some ruffed grouse or even devise a pet method of our own for determining the grouse population of the area. Since it is possible that our primary interest in the ruffed grouse is his fondness for a wooded area, we may wish to make an exhaustive study of his role in that particular community. Although his life history has been examined minutely by some authorities, this is not true of many birds. Accurate life histories are invaluable and are surprisingly rare for many of our species.

A Gallinaceous Bird

Possibly interest in the ruffed grouse stems from the fact that it is a gallinaceous bird and we may be drawn to observe all game birds in the locality. As regards migration, we may delight not only in distance records, but in examining information on dispersion and juxtaposition. Perhaps most of all the ruffed grouse is known for its behavior pattern, whether that be manifested in courting, the exotic drumming, or the cyclic undulations in population.

In relation to food, often the limiting factor in s specific locale, surveys of the plants and invertebrate life in the area are frequently desirable. To be of value, this should be done on a seasonal basis because, although this fact is not widely recognized, early spring food is of greater importance than that of any other season. Parasitism and disease, as well as mortality studies, are perhaps more difficult for the average worker's investigations. One reason that these aspects are less well developed in the study of ornithology is because the pathologist is confined to his laboratory and

ECOLOGICAL CLOCK & FACTORAL DESIGN FOR STUDIES IN BIRD ECOLOGY



normally does not have the opportunity to sample material from widely distributed sources. Those who follow the stock market, perchance will find it enjoyable to study the economics of bird population. Surely the ruffed grouse is eminently suitable for this purpose, since thousands of dollars are spent by sportsmen on its management.

Perhaps another approach to the study of these particular problems is that of a factorial one. This can be divided into two groups: physical and biological. Many interesting facts, otherwise often neglected, can be learned by the bird watcher who carries a thermometer with him. By correlating temperature findings with incidence, kinds, and numbers of birds seen, much of bird physiology can be understood. Mammalogists have learned that trapping of animals can be made more effective by a study of barometric pressure. Sudden drops in barometric pressure seem to incite major movements from one environment to another. Investigations as to the extent this applies to birds—to which species, how many individuals, and with what regularity—would make invaluable contributions.

What effect does light intensity have on birds? Can the difference in incidence found on a dull day be contrasted with that observed on a brilliant day? Is the difference between forest and meadow bird populations one of habitat or is it partly a question of light tolerance? Many of these problems could be answered if only camera enthusiasts would record light meter readings which they use on bird trips.

How much truth is in the saying, "A day fit only for ducks?" We know little of what birds do in a heavy downpour because of our own tendency to scuttle for shelter. Those who like to walk in the rain can add to our knowledge of this aspect.

The science of phenology deals with phenomena in respect to time. Most of us have recorded the first robin in spring, but who has a record of the first robin to leave an area in the fall?

The biological factors, although numerous, can be characterized in two large groups: intraspecific and interspecific relationships. The former deals with the relationships between the various groups of birds occuying the same habitat. The latter has to do with the relationships of birds of the same species in a specific area. Here we study cooperation, competition, and the everyday social problems that confront birds as individuals.

The normal human tendency to gaze admiringly after that other species which learned to fly before he did can be diverted with profit as well as with pleasure to serve greater scientific understanding. The ecological clock and factorial design here presented can be used in a hundred different ways to enrich our enjoyment of birds. Scientific knowledge is built up from the day to day observations made by a great many human beings, and the bird watcher can contribute his share.

Some Pro's and Con's

A PERSONAL CRITIQUE ON THREE ARTICLES

By LOUIS I. KUSLAN

Associate Professor of Physical Science, New Haven, Connecticut, State Teachers College

EDITOR'S NOTE: Because controversy often promotes ideas, we have decided to print, at some length, this "personal critique" on three articles published in this journal during the past few months: in the November 1956 issue, "A Century of High School Science," by Sidney Rosen, and "The Development of Scientific Laboratories," by Aaron J. Ihde; in the February 1957 issue, "Elementary School Science in the Past Century," by Gerald S. Craig.

In the letter accompanying his comments, Dr. Kuslan wrote, "I wish to call your attention to some points in these articles (Rosen and Ihde) which are controversial and worthy of comment. . . . I realize, of course, that it is impossible to do justice to the evolution of science teaching in American high schools in a brief article, and undoubtedly many of my points have already been anticipated by Dr. Rosen in his dissertation. Nevertheless, a controversial statement should be clearly labelled, and I have attempted to point out a considerable number of such statements in both papers."

Dr. Kuslan's letter also explained what prompted his critique. He wrote: "I am vitally concerned with the history of science education. My Ph.D. dissertation is a study of normal school science during the 19th century and I am presently writing a formal history of science education in the State of Connecticut.

"I did not believe it necessary in these remarks," he continued, "to cite authorities or research, but I am prepared to do so at any time. . . . I have limited my research and conclusions arising therefrom to a four-state area—New York, Connecticut, Massachusetts, and Rhode Island."

Because of space limitations, Dr. Kuslan's remarks have been edited.

SOME REMARKS RE "A CENTURY OF HIGH SCHOOL SCIENCE"

Dr. Rosen states that "science was taught primarily out of textbooks to high school pupils" until after the Civil War. I would agree that science teaching in the high schools was primarily textbook, an "evil" which endured *not merely* to the end of the war, but well *past* the first years of the 20th century. Schools which embarked on "laboratory" teaching, in the presently accepted meaning of the word, were few, and with some exceptions, the great host of small and medium sized high schools continued to rely on the textbook recitation. The textbooks, even as early as the 1840's were unlikely to be purely catechismal, that is, direct question-and-answer, as illustrated in Smith's *Illustrated Astronomy* (a book which was infrequently used in the Connecticut high schools).

Dr. Rosen rightly emphasizes the difficulty of securing competent science teachers, but couples this state of affairs with the normal school curriculum. Many 19th-century administrators do not seem to have been over-anxious to procure *science* teachers as such, at least not those busy men and women who were overlords of the horde of small two- or three-year high schools or high school departments. Their concern was far more immediate—hire someone, *anyone,* who could hold classes in a wide variety of subjects. A person specialized in science would perhaps have been much too specialized to have succeeded in the wide variety of tasks required of the "typical" high school teacher. May I point to a somewhat analogous situation today?

Furthermore, students attending the majority of liberal arts colleges simply could not have majored in science until the last two decades of the 19th century, and even with such a major, there were perhaps not more than three or four courses available in any given field of science. Only if the teacher had attended one of the scientific institutions, such as M.I.T., Rensselaer, Lawrence, or Sheffield was it possible to have become a specialist in science before the '80's. It cannot be assumed that a college graduate was automatically equipped to teach science, and for the greater part of the century, he was probably far better prepared to teach the classics than to teach natural philosophy, chemistry, or botany.

Dr. Rosen seems to believe that the high schools

were staffed with normal school graduates. This is not a valid assumption in Massachusetts, Connecticut, or Rhode Island, and is only partially valid in New York State. The number of normal school graduates in the high schools was always relatively small, and even then the normal school graduate was more likely to be teaching in one of the smaller high schools. In the Connecticut of 1904, there were more teachers who had graduated only from secondary schools teaching in the Connecticut high schools than had graduated from normal schools, 17 per cent to 15 per cent respectively, whereas 82 per cent had either attended or graduated from college (many teachers had attended both normal school and college); in Massachusetts in 1897, only 13 per cent of the high school teachers were normal school graduates, as compared to 67 per cent who were college graduates.

I object strongly to the selection of the 1894 New Britain Normal School curriculum as a specimen for scientific "horror." The Connecticut normal schools were guided by one specific purpose, and that was the preparation of teachers for the elementary schools. They did *not* attempt then, nor at any other time in the 19th century, to prepare secondary school teachers. In terms of their goals, and the two-year program which so limited them, the emphasis on science is remarkable, extending to over 25 per cent of all class time.

It would be much more legitimate to consider a normal school such as Bridgewater (Massachusetts) which did offer a four-year program preparing students for the better-paying school positions —principalships, high schools, grammar schools, supervisors. In the early '90's, a student interested in science would have taken a full year of physics, a full year of chemistry, two-thirds of a year of biology, a semester of physiology, a year of geology, and a semester of astronomy. The high school graduate with some attainment in science as determined by examination was allowed to take "maximum" work, which involved not only more time than listed above, but was at a level well above his high school courses (an achievement of little difficulty).

Science in the Bridgewater four-year curriculum amounted to a minimum of 20 per cent of the total time allotment, and is much less than what we would consider essential for a well-prepared teacher of high school science today. But in terms of the era, the Bridgewater graduate of the four year "maximum" work program was "well prepared" for the smaller high school in which he was also expected to teach algebra and latin in addition to the several sciences.

The four-year curriculum enrolled relatively few students. For example, in 1893, there were 13 graduates (nine men) as compared to 65 graduates (mostly women) from the two year program; and it is my impression, although I have not attempted to gather detailed information, that most of the four year graduates were destined for the city grammar schools. Almost every Bridgewater class in those years numbered men and women who became grammar school principals and teachers, along with one or two who graduated from college afterwards, often the Lawrence Scientific School at Harvard, assisted by state scholarships established for this purpose.

There are a number of other factors which raised the standards of normal school academic achievement well above all but the very best secondary schools—the excellent libraries, for example, which were hardly to be found in the high schools, and were actually unnecessary in such institutions, but which were in continual use in the normal schools. Then, too, the greater maturity of the student must be considered. The average entering age was 16 for women and 17 for men, and the actual average was higher than this, especially during the years before the '80's when many young men and women, teaching in the common schools with no education beyond the common school, realized the necessity for normal school training in order to prepare themselves for the better paying positions.

I realize, of course, that in a brief paper such as Dr. Rosen's, it is impossible to present the evidence which I am certain he has collected to document his statements. I do believe, however, that he must have over-generalized his conclusions.

RE DR. CRAIG'S PAPER

The historian of science teaching must meet the same standards for historical research which are demanded of any person who is called a "historian." The very recent paper by Professor Craig in the February issue of *The Science Teacher* may well serve as a case in point. I find little to criticize directly in Professor Craig's article because it is obviously an "intellectual" history of elementary school science, and is almost completely derived from Orra Underhill's remarkable *The Origins and Developments of Elementary-School Science.* Dr. Underhill clearly stated that he made no attempt "to discover what actually went on in the

(Please turn to page 188.)

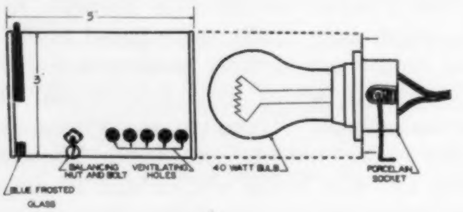
Classroom Ideas

Biology

Making an Effective Microscope Lamp

By ROBERT C. McCAFFERTY, Central High School, Wadsworth, Ohio, Illustrations by DICK THOMAS, 9th-grade student, Central High School

An effective sub-stage microscope lamp (Lamp A) may be easily constructed with little expense.

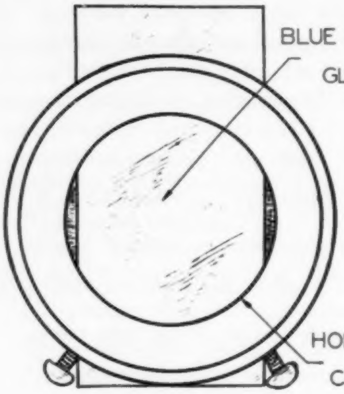


A

The housing consists of a waste tin can (3" x 5") from the kitchen. In the lid of the can, a hole is cut for a porcelain socket that screws together on either side of the lid. The socket, which is called a *sign receptacle,* will carry the standard 40-watt electric bulb. At the other end of the can, with the use of a can opener and tin snips (preferably aviation snips), a rectangular slit is cut in the cylinder to insert blue filter glass (2¼" x 3"). On the bottom of the cylinder, two small rectangular openings are cut for the lower corners of the glass to fit. (See illustration of front view.) Then the back end of the can is removed to make the front of the microscope lamp. The small bolt and nut on either side of the cylinder keep it from rolling. Finally, the can is painted with heat-resistant paint, the inside with aluminum paint, and the outside with black paint.

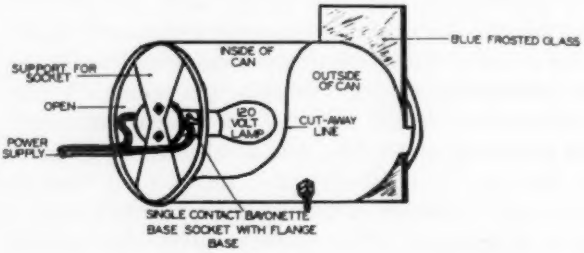
For the color filter glass, purchase inexpensive blue glass from a local glass shop. When the glass is held between an electric bulb and your eyes, the yellow cast of the light should become white. If the light shows much blue, a lighter shade of blue is needed. An excellent blue glass has the trade name *Lustrablue.*

At a glass shop you may have the edges and



FRONT OF MICROSCOPE LAMP

one surface ground on a carborundum wheel. On the other hand, a small quantity of finely ground carborundum powder (No. 120 or finer) may be purchased. The powder should be moistened with water and agitated between two pieces of blue glass. A minimum of grinding is desirable. Finally the glass is polished with steel wool.



B

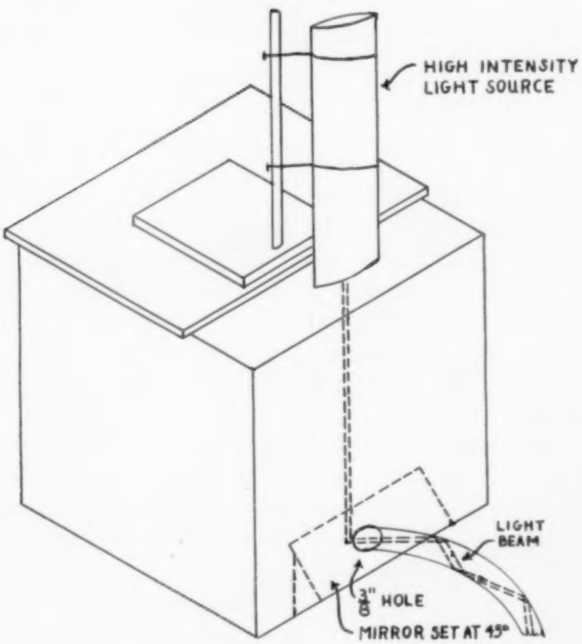
Lamp B may be fabricated according to the illustration. The parts, however, are not readily available and would need to be ordered by a retail dealer. The single pole, bayonette base, flange socket (#2029 S.C. socket) is manufactured by the Cole-Hersee Company, 20 Old Colony Avenue, South Boston 27, Massachusetts. A General Electric dealer may order the PH/30S11/1SC film-viewer lamp that is designed for 120 volts at 30 watts (average life: 50 hours). Another similar lamp for operation at 50 watts is PH/50S11SC projector type.

Physics

Illuminated Fountain

By CALVIN W. GALE, Wisconsin High School, Madison

One of the outstanding demonstrations in an introductory college physics course is the illuminated fountain which is used to illustrate the total internal reflection of light within a water column. This demonstration apparatus usually consists of a very large water tank set on a scaffolding about ten feet above the floor. High school physics teachers frequently demonstrate total internal reflection with a lucite rod or with a light bulb immersed in a water-filled can which has several holes punched in it. Neither of these last two demonstrations is very satisfactory.



A small model of the college physics illuminated fountain may be made with very few materials and with little effort. A one-cubic foot tank will hold enough water to provide a stream for several minutes. This tank may be constructed in the school shop. A one-fourth or three-eighths inch hole will allow enough water to pass to provide a stream large enough to be seen by all class members. Water faucets, gas cocks, or other valve devices are not satisfactory here since they tend to swirl the water and thus break up the stream. A one-holed rubber stopper plugged with a closed glass rod works very well. The glass rod allows some light to shine out, thus the task of adjusting the light source is simplified. The light source, a carbon arc or other high intensity source, is mounted as shown in the diagram and aimed at a mirror set at 45 degrees to the tank bottom.

When properly set up in a darkened room, this demonstration provides a spectacular illustration of total internal reflection. A light spot will be observed on the bottom of the sink or basin into which the water stream falls. Within the water stream, just after it leaves the tank, the light beam will be clearly observed through several reflections. When the tank is almost empty, the water stream will begin to break up and the light beam will be scattered. The area immediately around the stream will then be periodically illuminated. The demonstration may be enhanced by placing color filters in the light beam above the tank. Red and blue filters are particularly effective. As is the case with many physics demonstrations, the physics teacher will very likely be asked by some students to modify this one for use at the junior prom.

Chemistry

A Student Laboratory Experiment in the Analysis of Soaps and Soap Powders

By STEPHEN P. MARION, Department of Chemistry, Brooklyn College, New York

Motivation and interest are increased in the laboratory when the experiments deal with materials in everyday use. Here is such an experiment suitable for high schools, science clubs, and for colleges offering brief courses in chemistry. The techniques involved are simple and no unusual equipment or chemicals are used. Samples can be brought in by the students themselves. Such items can include toilet soaps, laundry soaps, soap powders, and mechanic's hand soaps. For those who prefer to include unknowns in this exercise, a method is mentioned whereby planned impurities may be added.

As a prelude to the actual laboratory work, the instructor can briefly outline the general principles of soap manufacture and explain the possible existence of some of the impurities to be found. At the end of the day's work, students can compare the results among the common brands and among the various types of cleansers.

Here is substantially the laboratory procedure.

After each item there is included the possible significance of each finding. Students are asked to bring samples in the original wrapper or container in order that valid direct comparisons may be made.

MOISTURE CONTENT

Some water is heated in a water bath. While waiting for this water to boil, weigh a clean, dry evaporating dish as carefully as possible on the trip scales. Then shave about five grams of soap into the weighed dish and weigh again. The difference in weight is the weight of the sample. Place the dish on the water bath and heat it for at least one full hour. During this time other determinations can be made. Cool the dish and weigh again. The loss in weight is the loss of moisture. Calculate the per cent of moisture (to the nearest per cent) in the sample.

$$\frac{\text{loss in weight}}{\text{weight of sample}} \times 100 = \quad \% \text{ moisture}$$

Significance

Better grades of toilet soap should contain no more than 15 per cent moisture. However, some grades of laundry soap may contain as much as 35 per cent moisture paid for at the price of soap.

FREE ALKALI

If the soap is white or a pastel shade, a drop or two of phenolphthalein indicator is added to a few shavings. A pink color indicates the presence of free alkali. With a soap that is dark colored, shake a few slivers of soap in a few milliliters of ethanol, then add a few drops of the phenolphthalein indicator to the liquid.

Significance

Free alkali should almost be absent from a high quality toilet soap. The presence of free alkali almost always reflects on poor manufacturing practices. Laundry soaps and soap powders will usually indicate more free alkali than toilet soaps.

CARBONATES

To test for the presence of carbonates, add a few drops of dilute hydrochloric acid to a water solution of the soap or to the soap itself. An effervescence indicates the presence of carbonates.

Significance

The detergent effect on greasy items is increased by the addition of sodium carbonate which also acts as a water softener. Excess amounts would be harmful to sensitive skins and to delicate fabrics. Toilet soaps usually do not contain added carbonates but mechanic's hand soaps and soap powders frequently do.

STARCH

Boil some of the soap in water. Let any undissolved matter settle. To the supernatant liquid add a drop or two of iodine-potassium iodide mixture. A blue color indicates starch.

Significance

Starch may be used as a filler or extender. It has little detergent action.

FREE FAT

A few grams of shaved soap are shaken with about 5 ml. of ether. Filter through a dry paper onto a clean watch glass. In a short time the filtrate will evaporate. A greasy residue indicates the presence of free fat.

Significance

Free fat may be due to incomplete saponification or to the intended addition of lanolin for skin softening. Fats other than lanolin are not readily absorbed by the skin and may leave a slight greasy film. Any appreciable amount of free fat is likely to be lanolin.

PHOSPHATE

A few shavings of the soap are boiled in about 5 ml. of water. To the supernatant liquid is added a few drops of dilute nitric acid and 1 ml. of ammonium molybdate reagent. The mixture is again heated. A fine granular yellow precipitate indicates the presence of phosphate. If the results are negative, the solution is not discarded for at least 15 minutes since the precipitate may take up to that length of time to form.

Significance

Phosphates in small quantities are likely to be found in some mechanic's gritty type hand soaps and in some soap powders. Phosphates are water softeners and like the carbonates increase the detergent action of the soap.

MATTER INSOLUBLE IN WATER

To about 250 ml. of water add about 3 grams of finely shaven soap. Heat gently until all that readily dissolves has done so. Let stand for ten to 15 minutes. Matter insoluble in water will settle to the bottom. Various samples can be compared on a visual basis.

Significance

Various gritty type hand soaps contain relatively large amounts of water-insoluble matter. Much of this is either fine sand or powdered pumice and the action of these materials is mechanical in that mild abrasion results from their

(Please turn to page 198.)

1957 Winners Science Achievement Awards for Students

(See picture story pages 174 and 175)

The following list includes the names of all students who won National Metals and Regional Awards. The student's name is followed by grade, project title, school, and name of teacher sponsor. While the supply lasts, a complete list, including students who won Honorable Mention, is available at the NSTA office.

NATIONAL METALS AWARDS

Bronstein, Gary (12): *Metallurgy of Silicon by Displacement from Fluorides and Alumno-Thermic Reduction;* Staunton Community H. S., Ill. **A. J. Markarian.**

Davis, Bette (9): *Prevention of Corrosion of Metals;* Macfarland Jr. H. S., Washington, D. C. **Betty Schaaf.**

Dohne, Brian (12): *Electroplating;* Anacostia H. S., Washington, D. C. **Elaine Kilbourne.**

Engle, Murray (12): *A Metallurgical Study and Examination of Carbon Steel;* Central H. S., Tulsa, Okla. **George W. Hall.**

Fantazier, Richard (11): *Titanium for Tomorrow;* St. Thomas H. S., Braddock, Pa. **Sister Ignatia Marie.**

Fraser, Lionel (8): *Low Melting Alloys and Their Conductivity of Electricity;* Jackson College Laboratory Sch., Miss. **Anna Wilson.**

Greyson, Eileen (12): *Lead Reduction by Three Methods;* Notre Dame H. S., Moylan-Rose Valley, Pa. **Sister Catherine Virginia.**

Johnson, Orwic (12): *Industrial Copperplating in Miniature;* Columbus Sr. H. S., Ind. **Lawrence Poorman.**

Kahler, Steve (12): *Uranium Electrolysis;* Westerville H. S., Ohio. **Joseph A. Ralston.**

Meier, Louise (10): *Determination of the Coefficient of Linear Expansion of Various Metals;* Hunter College H. S., New York, N. Y. **Emily E. Boggs.**

Melino, Donald (11): *Thermoelectricity;* La Salle Academy, Providence, R. I. **Brother A. Raymund.**

Pycraft, Jane (12): *Further Research on Unsolderable Materials;* Lorain H. S., Ohio. **Harold Freshwater.**

Radlein, Steven (11): *Electrolysis of Photographic Fixer;* Red Bank H. S., Chattanooga, Tenn. **M. A. Caballero.**

Reed, Larry (12): *Preparing Nickel Oxide Coating by Sputtering;* Alexander Ramsey H. S., St. Paul, Minn. **Ted Molitor.**

Reichert, John D. (12): *Development of Techniques in Inorganic Analysis Using Chromatography and Electrography;* S. F. Austin H. S., Austin, Tex. **Edna Boon.**

Sciubba, Louanna (12): *Crystalline Structure of Metals;* Notre Dame H. S., Moylan-Rose Valley, Pa. **Sister Catherine Virginia.**

Skloss, Jerry (12): *Separation of Sodium Chloride by Electrolysis;* St. Gerard H. S., San Antonio, Tex. **Sister Mary Louise.**

Stevens, Thomas (9): *Electrographic Analysis of Metals;* Macfarland Jr. H. S., Washington, D. C. **Betty Schaaf.**

Tobey, Nancy (8): *Specific Gravity of Metals by Archimedes Principle;* Hunter College Jr. H. S., New York, N. Y. **Jane K. Bonney.**

Toffer, Annika (8): *Analyzing Minerals;* Central Jr. H. S., Allentown, Pa. **Adolph Wagner.**

REGIONAL AWARD WINNERS

Region I

(Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont)
Howard E. Norris, *Chairman,* The Loomis School, Windsor, Conn.

GRADES 7-8

Bogrow, Paul (7): *Production of a Musical Tone by Mechanical Modulation of a Light Beam;* Weeks Jr. H. S., Newton Centre, Mass. **Stanley Russell.**

Kaufmann, Richard (8): *A Scientific Study of Wounds;* Weeks Jr. H. S., Newton Centre, Mass. **Stanley Russell.**

Knitter, James (8): *Vest Pocket Radio;* Westwood Jr. H. S., Mass. **Robert Swann.**

Pinel, Philip (8): *An Electroseismometer's Operation;* Weston H. S., Mass. **Dorothy Mulroy.**

Wypler, Jane (8): *Effects of Fertilizers on Coleus-Geraniums;* Weston H. S., Mass. **Dorothy Mulroy.**

GRADES 9-10

Batcheller, Diantha (9): *Comparison of the Flora of Three Different Plots;* Oyster River Co-op Sch., Durham, N. H. **Mrs. Robert Baxter.**

Goldberg, Alfred L. (10): *Zone Electrophoresis;* Classical H. S., Providence, R. I. **John Lafferty.**

Hamlin, David (9): *Photography in Nature;* Middlebrook Jr. H. S., Trumbull, Conn. **Thomas McCann.**

Kelly, Thomas J. (10): *Radio-Isotopic Research on Comparative P^{32} Absorption by Plants;* Weston H. S., Mass. **Wallace W. Sawyer.**

Wisner, George (9): *Sonar, The Ear of the Sea;* Bulkeley H. S., Hartford, Conn. **Mahlon Hayden.**

GRADES 11-12

DuBois, Denis (12): *Seismology, The Study of Earthquakes;* Matignon H. S., Cambridge, Mass. **Sister Mary Adelbert.**

Gruenig, David (12): *The Effects of Antibiotics on Escherichio Coli and Staphylococcus Epidermis;* Rockville H. S., Conn. **Dorothy Harlow.**

LaRochelle, Frances (12): *$CoCl_2$ and Atomic Radiation;* St. Joseph H. S., Manchester, N. H. **Sister Mary Beatrice.**

Nathanson, Robert (11): *The Effect of Various Fungicides on Trichophyton Mentagrophytes and Trichophyton Rubrum;* Wm. Hall H. S., W. Hartford, Conn. **J. Harold Rossiter.**

Romero, George (12): *Geology, A Study of Our Earth;* Suffield Academy, Conn. **Harold Wiper.**

Region II

(New Jersey, New York, Pennsylvania)
Abraham Raskin, *Chairman,* Hunter College, New York, N. Y.

GRADES 7-8

Mahoney, Jerry (8): *The Heredity of Guppies;* Briarcliff H. S., Briarcliff Manor, N. Y. **Donald Coe.**

Sarney, Laurie (7): *The Artificial Satellite;* Great Neck Jr. H. S., N. Y. **Mrs. Francis Regan.**

Shattuck, Charles (7): *Effect of Shifting the Center of Gravity on Aircraft;* Herricks Jr. H. S., New Hyde Park, N. Y. **Flora Kahme.**

Toffer, Annika (8): *Analyzing Minerals;* Central Jr. H. S., Allentown, Pa. **Adolph Wagner.**

Wiesner, John (7): *Scientific Function of Amateur Radio;* St. Teresa of Avila, Albany, N. Y. **Sister Mary Alice.**

GRADES 9-10

Cohen, Ira (10): *Effect of a Sedative on the Reproduction Rate of Paramecium Caudatum;* Bronx H. S. of Science, N. Y. **Paul Kahn.**

Heininger, Patrick (9): *The Submarine;* Moon H. S., Coraopolis, Pa. **Grace Crawford.**

Sokol, Robert (10): *Constant Recrystallization of Sodium Thiosulphate by Supersaturation;* Monroe H. S., Rochester, N. Y. **Marion Cummings.**

Stewart, Timothy (9): *Underwater Camera;* Jonathan Daton Regional School, Springfield, N. J. **Walter A. Hohn.**

Tate, Michael (10): *The Effects of High Altitude on Living Organisms;* Bronx H. S. of Science, N. Y. **Paul Kahn.**

GRADES 11-12

Baum, William M. (12): *The Social Order of Male White Mice;* Bronx H. S. of Science, N. Y. **Edward Frankel.**

Hameroff, Nathan (12): *A Study of the Stresses Induced by Orthodontic Tooth Movement in Bone, Using the Photo-elastic Method and Gelatin as the Transparent Medium;* Abraham Lincoln H. S., Brooklyn, N. Y. **Michael Idelson.**

Hilbert, Robert (12): *Cycloramic Camera;* Forest Hills H. S., N. Y. **Saul Geffner.**

Milner, Richard (11): *Releasing the Following-Response in White Pekin Ducklings;* Martin Van Buren H. S., New York, N. Y. **Joseph Castka.**

Okun, Lawrence (11): *Ascites Tumors, A Preliminary Study;* Kenmore Sr. H. S., N. Y. **Louise Schwabe.**

Region III

(Delaware, District of Columbia, Kentucky, Maryland, North Carolina, Tennessee, Virginia, West Virginia) Robert T. Lagemann, *Chairman,* Vanderbilt University, Nashville, Tenn.

GRADES 7-8

Holverstott, Richard (8): *The Effect of Antibiotics on Rats Which Have Been Injected with Staph Albus as Shown by Blood Counts;* Hart Jr. H. S., Washington, D. C. **Mabel Duvall.**

Lady, Charles (8): *The Electronic Echo;* Takoma Park Jr. H. S., Silver Spring, Md. **Mrs. A. J. Birthright.**

Rogosa, Victor (8): *Growth of Bacteria in Raw Milk;* Leland Jr. H. S., Chevy Chase, Md. **Anita Bickford.**

Sachs, Ellen (8): *Iodine and the Thyroid;* Leland Jr. H. S., Chevy Chase, Md. **Anita Bickford.**

Snyder, Carolyn (8): *Chlorella;* Macfarland Jr. H. S., Washington, D. C. **Betty Schaaf.**

GRADES 9-10

Appleton, Jean Ann (9): *Pigeon Navigation & Orientation;* Hyattsville Sr. H. S., Md. **Donald Higgs.**

Bollt, Steven (9): *The Principles Involved in the Construction of a Newtonian Telescope;* Leland Jr. H. S., Chevy Chase, Md. **Anita Bickford.**

Grimm, Wayne (10): *Distribution of Mollusca in Woodland Cemetery, Baltimore, Md.;* Catonsville Sr. H. S., Md. **Frances Davidson.**

Lavine, Leslie E. (9): *To What Extent Can My Camera Be Used for Photographing Celestial Bodies?;* Leland Jr. H. S., Chevy Chase, Md. **Anita Bickford.**

Nolan, Michael (10): *The Construction and Operation of a Cupola;* Notre Dame H. S., Chattanooga, Tenn. **Sister Hyacinth.**

GRADES 11-12

Blum, Edward (12): *Quantitative Determination of Metallic Ions by Column Chromatography;* High Point H. S., Beltsville, Md. **William C. Bond.**

Freedenberg, Philip (12): *Chemotherapy of Leukemia;* Montgomery Blair H. S., Silver Spring, Md. **William W. Saunders.**

Gladstone, Irwin (12): *Experimental Wind Tunnels;* Woodrow Wilson H. S., Portsmouth, Va. **Beatrice B. Fordham.**

Rice, Jerry (11): *Electrophoretic, Biochemical, and Physiological Analysis of Lymph and Plasma Proteins of Normal and Cancerous Rabbits;* Anacostia Sr. H. S., Washington, D. C. **Elaine Kilbourne.**

Robinson, George S., Jr. (12): *Photoelastic Stress Analysis;* Woodrow Wilson H. S., Washington, D. C. **Rebecca E. Andrews.**

Region IV

(Alabama, Arkansas, Canal Zone, Florida, Georgia, Louisiana, Mississippi, Puerto Rico, South Carolina) Katherine Hertzka, *Chairman,* Hoke Smith High School, Atlanta, Ga.

GRADES 7-8

Alexander, Marion (8): *A Study of Invertebrate Fossils;* Jackson College Lab. Sch., Jackson, Miss. **Anna Wilson.**

Briggs, Bobby (7): *A Simple Use for the Modern Transistor and Solar Battery;* Bailey Jr. H. S., Jackson, Miss. **Nancy Lay.**

Fraser, Lionel (8): *Low Melting Alloys And Their Conductivity of Electricity;* Jackson College Lab. Sch., Jackson, Miss. **Anna Wilson.**

Guyton, David (8): *Miracles of Light;* Bailey Jr. H. S., Jackson, Miss. **Thomas Lindley.**

Mosley, Wilma (8): *Ciliates Found In Local Ponds;* Jackson College Lab. Sch., Jackson, Miss. **Anna Wilson.**

GRADES 9-10

Bouchard, Dennis (10): *How The Boll Weevil Destroys;* Greenwood Sr. H. S., Greenwood, Miss. **B. L. Ricks.**

Bray, Brenda (9): *Conditioned Reflexes in the Guinea Pig;* A. L. Miller Jr. H. S., Macon, Ga. **Ruby Tanner.**

Davis, Randolph (9): *Van de Graaff Static Generator;* Greenwood H. S., Greenwood, S. C. **Elizabeth Adams.**

Dunson, William A. (10): *Concentration of Radiophosphorus By Fresh-Water Algae;* Northside H. S., Atlanta, Ga. **Julia Newton.**

Friedman, Alan J. (9): *Improved Photography—Solid Chemicals;* North Fulton H. S., Atlanta, Ga. **Belle B. Cooper.**

GRADES 11-12

Fuller, David (12): *A New Type Wide-Angle Photographic Lens;* Northside H. S., Atlanta, Ga. **Julia Newton.**

Lucas, Thomas R. (12): *An Algebraic Method of Solving Problems of the Infinitesimal Calculus;* H. B. Plant H. S., Tampa, Fla. **Harry Tropp.**

Maxwell, Barry (12): *Effect of Nephrectomy On Urea Elimination;* Winter Haven H. S., Fla. **Chester A. Mann.**

Nelson, Dick (12): *Sound Reproduction In High Fidelity;* Jordan Vocational H. S., Columbus, Ga. **C. H. Weissinger, Margaret Gunter.**

Porch, Tommy (12): *Comparative Growth and Development of New Varieties of Azaleas;* Murphy H. S., Atlanta, Ga. **Helene Lammers.**

Region V

(Illinois, Indiana, Michigan, Ohio)
Walter E. Hauswald, *Chairman,* Sycamore Community High School, Ill.

GRADES 7-8

Booth, Jane (8): *These Pests Are Poison;* Rochester Jr. H. S., Mich. **R. C. Stocker.**

Chalberg, William (8): *A Study of Electronics Based on the Lowrey Organ;* Haven Jr. H. S., Evanston, Ill. **Louise E. Hollweg.**

Inouye, Dennis (7): *A Rocket's Cross Section;* Haven Jr. H. S., Evanston, Ill. **Alfred Lazow.**

Swisher, Sue (8): *Circulatory Development of the Chick Embryo;* Nichols Sch., Evanston, Ill. **Arthur Niemann.**

Worland, Chris (7): *Binary Comparison Computer;* Haven Jr. H. S., Evanston, Ill. **Alfred Lazow.**

GRADES 9-10

Hexter, Michael (9): *Lethal Effects of Ultrasonic Sound on Lebistis Reticulatus;* Hawken Sch., Cleveland, Ohio. **Byron Williams.**

Hyman, Judith (10): *Hormones: Their Effects on Rabbits;* Shaker Heights H. S., Ohio. **Jack Miller.**

Leitelt, Mary Ellen (9): *Comparison of the Hardness of Alloys;* Aquinas H. S., Chicago, Ill. **Sister John Maureen.**

Severance, Don (9): *What Are and What Can Be Done for the Soils of Antrim County;* Bellaire H. S., Mich. **M. Helen Kemp.**

Spencer, Alfred (9): *Crossed Wishbone Wheel Suspension for Sports and Grand Prix Cars;* Cedarville H. S., Ohio. **Robert Guthrie.**

GRADES 11-12

Hyne, Norman (12): *Identification and Qualitative Chemical Analysis of Minerals;* Lyons Township H. S., LaGrange, Ill. **Kenneth Hunt.**

Leffler, Marlin F. (12): *The Design and Construction of an Original Electromechanical Digital Computer;* Middletown Sr. H. S., Ohio. **D. Clyde Yocom.**

Rexford, Rexley (12): *Development of Astronomical Demonstrators;* Lyons Township H. S., LaGrange, Ill. **Kenneth Hunt.**

Reynolds, Margaret (12): *A Comparative Study of the Effect of Thiouracil and Injected Thyroxin on the Growth of Thyroid Glands of Chicks;* George Washington H. S., Indianapolis, Ind. **Elizabeth H. Crider.**

Schlatter, Vee (12): *Toxicology of Latrodectus Mactans;* Archbold German Township Local Sch., Ohio. **George Clark.**

Region VI

(Canada, Iowa, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Wisconsin, Wyoming)
James A. Rutledge, *Chairman,* University of Nebraska, Lincoln.

GRADES 7-8

Ackermann, Mary (8): *Measuring the Adhesive Quality of Dye-Hesive Glues;* U. S. Grant H. S., Sheboygan, Wis. **Walter Lartz.**

Imig, Arthur (8): *Construction of A Coronagraph;* U. S. Grant H. S., Sheboygan, Wis. **Walter Lartz.**

Katte, Judy (8): *Conditions Conducive to the Growth and Control of Bacteria;* U. S. Grant H. S., Sheboygan, Wis. **Walter Lartz.**

Raudenbush, Wendy (8): *Embroyology of the Chick;* Ramsey Jr. H. S., Minneapolis, Minn. **Donald Bevis.**

Yonke, Ronnie (7): *Reusing Waste Paper;* Wausau Jr. H. S., Wis. **A. H. Yonke.**

GRADES 9-10

Ecklein, David (10): *The Use of Sound for the Measure of Distance;* Cedar Falls H. S., Iowa. **Anton Hofstad.**

Henderson, Jim (10): *A Study of Blood Coagulation;* Cedar Falls H. S., Iowa. **Anton Hofstad.**

Mohalski, Robert (10): *Photomicography;* Notre Dame H. S., Milwaukee, Wis. **Sister M. Natalia.**

Sigelman, Paul S. (9): *The Quest of Atomic Power and Medicine;* Washington Jr. H. S., Fergus Falls, Minn. **C. O. Barsness.**

Weeks, Dennis (9): *Some Notes On the Evolution and Phylogeny of the Lobopods;* Northeast Jr. H. S., Lincoln, Neb. **Ellis Jeffrey.**

GRADES 11-12

Bening, Lionel, Jr. (12): *A New Method of Electrical Tic-Tac-Toe Analysis;* Cotter H. S., Winona, Minn. **Sister M. Bibiana.**

Gollnick, Daniel A. (11): *The Effects of Natural and Manmade Phenomena On the Background Count;* Central H. S., La Crosse, Wis. **Ole Oines.**

Kramer, Jerome (12): *A Study of Soil Conservation in Dubuque County, Iowa;* Xavier H. S., Dyersville, Iowa. **Sister M. Cecilia.**

Neuman, Michael (12): *A Comparison of Simple Electrometric and Radio Frequency Conductimetric Titrations;* Shorewood H. S., Wis. **Harold Wierks.**

Stanek, James (12): *Archaeology of Sterns Creek;* Benson H. S., Omaha, Neb. **Paul Ackerson.**

Region VII

(Colorado, Kansas, Missouri, New Mexico, Oklahoma, Texas)
S. Winston Cram, *Chairman,* Kansas State Teachers College, Emporia.

GRADES 7-8

Alpha, Sigma (7): *How Sound Waves Are Recorded by Seismograph;* Wheat Ridge Jr. H. S., Colo. **Richmond Gore.**

Biggs, Ann (8): *Bass in Missouri;* Brentwood H. S., Mo. **Charles Duggan.**

Deutsch, Larry (7): *Impact Testing of Plastic Film;* Hanley Jr. H. S., University City, Mo. **Melvin Shourd.**

Horton, Margaret (8): *Comparative Anatomy and Physiology of Lower Representative Animals Including Dissection of Same;* Mulvane Jr. H. S., Kans. **Armin W. Johnson.**

Wilcox, Pete (7): *Insect Wings and Their Structure;* Wheat Ridge Jr. H. S., Colo. **Richmond Gore.**

GRADES 9-10

Ford, Kenneth (10): *The Origin of the Moon;* Field Kindley H. S., Coffeyville, Kans. **William Lynn.**

Baca, Gene (9): *Handedness Phenomenon in Porcupines;* Center Consolidated Sch., Colo. **Leonard H. Pratt.**

Lowder, Jeanene (9): *Preliminary Flora Analysis of the San Luis Valley;* Center Consolidated Sch., Colo. **Leonard H. Pratt.**

Weller, Morris (10): *Relationship of Plant Tumors and Animal Cancer;* Abilene Sr. H. S., Tex. **Mary Grubb.**

Wideman, C. D. (9): *3000 Yards of Geology;* Brentwood H. S., Mo. **Charles D. Duggan.**

GRADES 11-12

Bridson, William (12): *Physiological Studies in Parabiosis;* East H. S., Wichita, Kans. **Gerald Tague.**

Burns, Pat (11): *Gravitational Force on Liquids;* Center Consolidated Sch., Colo. **Leonard H. Pratt.**

Odom, Larry (11): *Photographing the Solar Spectrum;* East H. S., Wichita, Kans. **Gerald Tague.**

Reichert, John D. (12): *Development of Techniques in Inorganic Analysis Using Chromatography and Electrography;* S. F. Austin H. S., Austin, Tex. **Edna Boon.**

Salser, Winston (12): *A Study of the Effects of Ionizing Radiations on Plants and Animals;* East H. S., Wichita, Kans. **Gerald Tague.**

Region VIII

(Alaska, Arizona, California, Hawaii, Idaho, Nevada, Oregon, Utah, Washington)
Gertrude W. Cavins, *Chairman*, San Jose State College, Calif.

GRADES 7-8

Dickman, Coralyn (7): *Effects of Differences in Marine Environment;* Woodrow Wilson Jr. H. S., Oakland, Calif. **Maurice Phelan.**

Grant, Sandra (8): *Mitosis;* Lindbergh Jr. H. S., Long Beach, Calif. **Francis St. Lawrence.**

Melchonian, Patricia M. (8): *Chemical Spectroscopy;* Westlake Jr. H. S., Oakland, Calif. **Maurice Phelan.**

Williamson, Dan (7): *Colorless Color Wheel;* Santa Barbara Jr. H. S., Calif. **Ivan Evans.**

Yano, Joyce (7): *Measuring Mouse Intelligence;* Woodrow Wilson Jr. H. S., Oakland, Calif. **Maurice Phelan.**

GRADES 9-10

Angle, Karen (9): *Project Sunspots;* Lincoln Jr. H. S., Santa Monica, Calif. **Mary Knowlton.**

Beaty, Kathryn (10): *Salk Polio Vaccine Survey;* North Salem H. S., Salem, Ore. **Fay Mort.**

Becker, Terry (9): *Cancer Research;* Gresham Union H. S., Ore. **Irma Greisel.**

King, Barbara (9): *Effects of Wine and Tobacco on Rats;* James Lick H. S., San Jose, Calif. **June O'Brien.**

Vittor, Frank (10): *Astronomical Photography with Homemade Instruments;* El Cajon Valley H. S., El Cajon, Calif. **Edith Curry.**

GRADES 11-12

Ackers, Gary K. (12): *An Experimental Determination of the Relationship Between Growth Rate and Temperature of Bacillus Thermoamylolyticus;* Berkeley H. S., Calif. **Henry M. Nelson.**

Balderree, Willis, Jr. (12): *A Study of the Synthesis of Coordination Compounds of Cobalt;* Grants Pass H. S., Ore. **Cecil Petit.**

Calahan, Brian (11): *Extracting Metals by Solar Energy;* Tamalpias H. S., Mill Valley, Calif. **Raymond Palmer.**

Mason, John H., Jr. (11): *An Experimental Study of the Effects of Variations in Physical Surroundings on the Brain Waves of Various Animals;* George Washington H. S., San Francisco, Calif. **John Burke.**

Morrison, James (11): *Systems in Electro-Mechanical Binary Computation;* Beaverton Union H. S., Ore. **Michael Fiasca.**

KUSLAN—continued from page 181

classroom, as teachers endeavored to work out these programs, nor to discover the extent to which these plans affected practice." It should be obvious that this kind of study is extremely important, but it reveals only one part of the picture, and that actual practice in the classroom must be examined with all its successes and failures before a balanced assessment of the development of science teaching can be possible.

RE DR. IHDE'S PAPER

I am somewhat surprised by Dr. Ihde's apparent approval of early high school laboratory work as "often extensive in character" when, in the very next paragraph, he emphasizes the necessity for limiting the number of experiments—the inference throughout being that what was done 75 years ago was better than laboratory instruction today. He goes on to describe such laboratory work as "well integrated" into the body of science. May I suggest that Professor Ihde turn to a widely used chemistry manual prepared for the secondary schools—*Elementary Manual of Chemistry*, by Eliot, Storer, and Nichols—published in 1872.

Professor Ihde and I are both concerned about the status of the high school laboratory, but for diametrically opposed reasons. He is alarmed by a deterioration in the quality of laboratory instruction. I am concerned because laboratory instruction has progressed less rapidly in terms of its potential contributions than we could reasonably have expected. Despite repeated claims, past and present, for the individual laboratory experiment as a means of developing ability to think scientifically, we have yet to make the laboratory function effectively in this direction, whether such instruction is in the elementary school, the high school, or the college.

The laboratory has not "deteriorated"—it has merely moved ahead much too slowly for comfort. This is the problem which those of us who believe in laboratory instruction must solve.

N·S·T·A LIFE MEMBERS

PACING THE STEADY CLIMB in over-all NSTA membership, the Life Member roster shows a record increase of 74 since the last announcement in *TST*. This conspicuous gain has been registered since November 19, 1956. As of April 20, 1957, **the Life Member roll totalled 314, of which 41** were from New York State. California is second among the states with 32 Life Members.

The new Life Members represent 30 states, the District of Columbia, and Alaska.

In addition to the professional distinction that goes with Life Membership, this "inner core" of the Association has also developed a special *camraderie* that is evident when even a few Life Members get together. In Cleveland, for example, at the 5th National Convention in March, the Life Membership breakfast was one of the high spots of the semi-social part of the program. The breakfast was scheduled for 7:30 a.m. on Saturday, last day of the convention, when weariness was prevalent. Nevertheless, 49 Life Members showed up, including seven presidents, past, current, and president-elect.

Following are the 74 new Life Members:

Allman, Verl P., Provo, Utah
Barnard, J. Darrell, New York, New York
Beacom, Seward E., New Britain, Connecticut
Blasyk, Edwin A., Detroit, Michigan
Bliss, Horace H., Norman, Oklahoma
Blough, Glenn O., College Park, Maryland
Brieske, Phillip R., College, Alaska
Brogan, Charles W., Tempe, Arizona
Bromberick, Lawrence E., Poughkeepsie, New York
Brook, William V., Huntington, West Virginia
Brooks, Merle, Emporia, Kansas
Campbell, Mrs. Marjorie M., Washington, D. C.
Carlson, Lawrence L., West Concord, Minnesota
Carr, Michael, Selma, Alabama
Cavins, Gertrude W., San Jose, California
Cress, Luther M., Fort Lupton, Colorado
Dean, Peter M., New York, New York
Estee, Charles R., Vermillion, South Dakota
Ewin, Harold, Levittown, New York
Farr, William N., Monmouth, Illinois
Gebhart, James W., Missoula, Montana
Glidden, Harley F., Greeley, Colorado
Gray, Elizabeth K., Richmond, Virginia
Halterman, Richard J., Salt Lake City, Utah
Hammond, Mrs. Katherine, Falls Church, Virginia
Heller, Lester, Silver Spring, Maryland
Hrisko, William F., Pennsburg, Pennsylvania
Innes, Kenneth, Vallejo, California
Isbell, David W., Greenville, California
Jervis, Roy N., Tallahassee, Florida
Jones, Jessie M., Littleton, North Carolina
Jordan, Robert F., Detroit, Michigan
Kuhn, Edward T., Tucson, Arizona
Kyes, Alberta Platt, Detroit, Michigan
Laughlin, Mrs. Ethelreda, Cleveland, Ohio
Levitan, Harvey H., Philadelphia, Pennsylvania
Long, Arthur, Anita, Iowa
Louderback, H. M., Spokane, Washington
Low, W. Blair, Fillmore, Utah
Luke, Margaret N., New York, New York
Massaro, Salvatore, Pedro Valley, California
Meder, Elsa, Boston, Massachusetts
Merlo, Frank P., Paterson, New Jersey
Miescke, Carl F., San Jose, California
Miller, Mrs. Maude, Georgetown, South Carolina
Monroe, Helen M., Detroit, Michigan
Pennington, R. M., Des Moines, Iowa
Phillips, Davida E., Tulsa, Oklahoma
Piel, Emil J., North Caldwell, New Jersey
Pierce, Richard, San Francisco, California
Ramos, David E., San Francisco, California
Reuter, John F., Chicago, Illinois
Richards, James E., Jr., North Bend, Oregon
Rosen, Sidney, Waltham, Massachusetts
Saville, Richard L., South Norwalk, Connecticut
Schawillie, Joseph P., North Tonawanda, New York
Schenke, Lahron H., Springfield, Missouri
Sister Mary Dorothy, Toledo, Ohio
Skirvin, Madeleine T., Baltimore, Maryland
Smith, Herbert A., Lawrence, Kansas
Sproles, Carl R., Ashtabula, Ohio
Stanford, Mrs. Edythe, Orangeburg, South Carolina
Stotler, Donald W., Portland, Oregon
Sullivan, Allie N., Huntington, West Virginia
Taylor, Mrs. L'Dora, Dallas, Texas
Tivnan, Andrew J., Clinton, Massachusetts
Trombley, Howard B., Caldwell, New Jersey
Varbalow, Theodore H., Philadelphia, Pennsylvania
Versput, Robert F., Dover, New Jersey
Voth, Edward, Fargo, North Dakota
Walk, Louis, Des Moines, Iowa
Wasson, Joe K., Monmouth, Illinois
Wickline, Jayne H., Rainelle, West Virginia
Youngstetter, Frank O., Detroit, Michigan

NSTA Activities

Annual Summer Meeting

The annual NSTA summer meeting has certain special aspects this year. For one thing, it will be held in conjunction with the significant Centennial Convention of the National Education Association. For another, it will be a joint meeting with the National Council of Teachers of Mathematics (NCTM).

The date of the meeting is July 1 and the place is the Hotel Sheraton in Philadelphia, Pennsylvania. The theme for the morning session is "Implications of Science and Mathematics for Our Modern Culture." The speakers will be: for science, L. Earle Arnow, director of research, Merck Sharp & Dohme, West Point, Pennsylvania, and, for mathematics, Morris Kline, professor of mathematics, New York University. Presiding at the session will be Glenn O. Blough, who, that very day, takes office as NSTA president.

The theme for the afternoon sessions is "Steps Toward the Improvement of Science and Mathematics Teaching." The speakers will be: for science, Ellsworth S. Obourn, of the U. S. Office of Education, Washington, D. C., and, for mathematics, Bruce E. Meserve, chairman, Department of Mathematics, Montclair State Teachers College, New Jersey. M. H. Ahrendt, executive secretary of NCTM, will preside.

Both sessions will also feature panel speakers. Further details of the program are available at NSTA headquarters and will be sent on request. The NSTA co-chairmen for the meeting are Walter S. Lapp, of Overbrook High School, Philadelphia, and Nathan A. Neal, of McGraw-Hill Book Company, Inc., New York City, both past presidents of NSTA.

Northeast Conference

There's a progress bulletin in from Connecticut which portends a stimulating and constructive meeting there in the fall. It is the Northeast regional conference which will be held October 18 and 19 at the Hotel Statler in Hartford. The chairman is Frederick W. McKone, of Teachers College of Connecticut, New Britain.

The theme of the meeting is "Improving the Science Program, Kindergarten through College." The keynote address will be given by Ernest Pollard, of the Department of Biophysics, Yale University. Following this address, the conference will divide into three sections, one on facilities for teaching science, a second on professional growth of science teachers, and a third on meeting individual needs in science.

TST's next issue, in September, will report more details on the Northeast meeting. In the meantime, those wanting specific information can write to NSTA headquarters.

Denver Convention

There's exciting news, too, from the Denver "front," where rapid progress is being made with the program design and schedule for NSTA's 6th National Convention. Under the chairmanship of Donald G. Decker, of the Colorado State College of Education at Greeley, the convention planning committee is already in the process of writing in names of participants in the program. That means it's not too early now for teachers interested in being leaders or counselors in discussion groups to volunteer. The same goes for those who'd like to take part in Here's How I Do It presentations. Write to Dr. Decker at Greeley and offer your services.

There'll be a lot more news about the Denver convention in *TST's* first fall issue. For now, be sure the dates are on your 1958 calendar—in red letters: March 26-29.

Tomorrow's Scientists

The sixth and last issue of Volume 1 of *Tomorrow's Scientists* is about to go to press and NSTA's editorial staff is now considering publication plans for 1957-58. There are approximately 10,000 subscriptions to this junior-senior high school student paper; the original goal for the first year when Issue No. 1 appeared last October was 5000.

The success of the paper has made it clear that there should be an expanded publication schedule next year. Also, there is a need for this expansion because of the financial situation.

In order to get the paper underway this year, its publication was subsidized by the Future Scientists of America Foundation. In the coming year, NSTA wants to make it an even better and more serviceable paper and, at the same time, have it "stand on its own feet" financially. It is believed the paper can be self-supporting at the present subscription rate of 50 cents per student per year and a minimum of five subscriptions to any one address—*providing* we can hit 20,000 subscribers.

What's your reaction? Write your opinion to *TS's* editor, Robert H. Carleton, National Science Teachers Association, 1201 Sixteenth Street, N.W., Washing-

ton 6, D. C. Also write any criticisms, comments, new ideas, or other suggestions you may have for the editorial content of the paper. And, with vacation not too far away, this might be a good time to suggest to your students that they spend a little time this summer writing articles for *Tomorrow's Scientists.* Each student author gets a by-line, of course.

Business-Industry Section

A new Executive Committee was elected by NSTA's Committee on Business-Industry Relations during the Association's 5th National Convention at Cleveland, Ohio in March. Composed of representatives of business and industry interested in furthering NSTA's aims, the B-I group is an active link between science teaching and industry.

The new Executive Committee, which holds office until next March, consists of:

Chairman: Robert C. Lusk, Automobile Manufacturers Association, Detroit, Michigan

Vice-chairman: Julian Street, United States Steel Corporation, New York City

Secretary: Thelma Scrivens, Hill and Knowlton, Inc., New York City

Treasurer: Owen Hunsaker, United Air Lines, New York City

John McGill, American Trucking Associations, Inc., Washington, D. C.

George Seidel, E. I. du Pont de Nemours & Company, Wilmington, Delaware

At its Cleveland meeting, the B-I Committee voted to contribute $100 to the NEA building fund. This was decided upon in view of the fact that this is the NEA Centennial year—and the new headquarters building is now partially completed, but still under construction in the nation's capital.

Changing Address?

If you're changing your address for the summer only, do *not* notify NSTA headquarters. The next mailing of NSTA materials will be the September issue of *The Science Teacher,* so you need not be concerned about missing your mail during the summer months.

If, however, you are changing your *permanent* address, be sure to notify the Membership Secretary at the NSTA office as soon as possible. Remember that second class mail is not forwarded, so if you neglect to send in the new address before fall, you will miss the first NSTA mailings of the new school year. June 15, incidentally, is the deadline for new addresses to go into the *1957 Membership Directory.*

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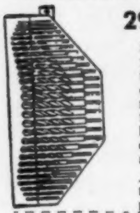

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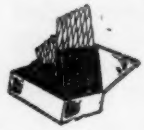

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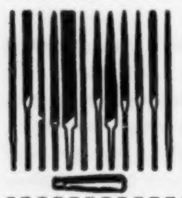

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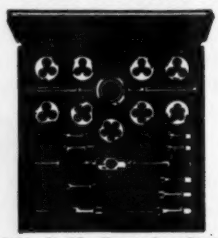

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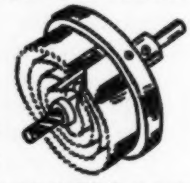

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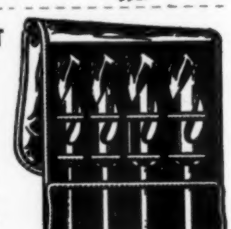

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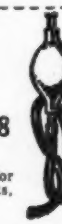

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( ) Deluxe Arco Hole Saw—$6.50 ppd.
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FSA Activities

Roster of Sponsors

By mid-April, 1957 had already marked itself as by far the most successful year yet in terms of FSAF support from its financial sponsors. Their number, their promptness with 1957 checks, and their generosity are inspiring evidence of industry's interest in encouraging future scientists.

It is interesting how many different, science-related fields are represented by the FSAF sponsors. To name but a few, they range from aircraft to cosmetics, from oil to steel, from chemical companies to machinery manufacturers, and from pharmaceutical firms to ceramic and timber groups. The roll of FSAF sponsors literally demonstrates how wide are the career opportunities for the future scientist and the scope of the choice that lies before the science student when he or she decides on science as a career.

By mid-April, 42 business-industry organizations had contributed more than $50,000 for general and special FSAF projects. Seven of these are first-time sponsors. Among the seven is the Scott Paper Company Foundation, of Chester, Pennsylvania, which is providing funds for a special conference this summer. Designed to help improve high school chemistry teaching, the conference will be held from August 19 to 30 at Swarthmore College, Swarthmore, Pennsylvania. The grant will provide fellowships and expense stipends for 25 teachers of chemistry from high schools in southeastern Pennsylvania. The conference co-directors are Dr. Walter B. Keighton, head of the chemistry department at Swarthmore, and Robert H. Carleton, NSTA's executive secretary. Dr. Walter S. Lapp, a past NSTA president and head of the science department at Overbrook High School in Philadelphia, will serve as special consultant to the conference.

Since the announcement of the 1957 sponsors in the April *TST*, 14 more have been added to the roster. They are:

Atlas Powder Company
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National Institute of Ceramic Engineers
The Pfizer Foundation, Inc.
Raytheon Manufacturing Company
The Scott Paper Company Foundation
Temco Aircraft Corporation
Westinghouse Educational Foundation
Weyerhaeuser Timber Foundation

New Appointee

Dr. Samuel L. Meyer, dean of Central College in Fayette, Missouri, has been appointed to the FSAF Administrative Committee. His appointment brings the membership of the committee to the full ten authorized by the NSTA Board of Directors last summer when the FSAF administrative setup was revised. Six members of the committee are appointive members, with two named each year to serve three-year terms. The other four members are from the NSTA Executive Committee, namely, the president, president-elect, executive secretary, and treasurer.

Dr. Meyer, who will meet with the Administrative Committee for the first time at its May 11-12 session in Washington, D. C., was formerly executive secretary of the American Institute of Biological Sciences.

Cooper-Bryan Report

Another link between science education and industrial employment has been forged. It is in the form of an FSAF report, which has been prepared by Mr. Edwin Cooper, of Madison High School, Madison, New Jersey, with Dr. Ned Bryan, of the School of Education, Rutgers University, New Brunswick, New Jersey, as project advisor. Since last winter, the two have been conducting a study of policies and practices followed in industry's summer employment of science teachers. Their completed report will be available about the time this issue of *TST* comes off the press.

Authorized by the FSAF Administrative Committee at its fall meeting last year, the study and the report are unique in their field. They represent a far more extensive and detailed evaluation of industry summer employment practices, as related to science teachers, than has hitherto been done. The report will be widely distributed to industry and is expected to serve as a practical guide in industry's future plans for employment of science teachers during the summer.

Single copies of the report are free on request. Write to the National Science Teachers Association, 1201 Sixteenth Street, N.W., Washington 6, D. C.

ODISHAW—continued from page 171

observations and measurements were impossible. Conventional balloon techniques, like those used in weather observations, do not extend beyond some 24 miles, and so studies of the upper atmosphere have depended upon indirect measurements such as those made in probing the ionosphere.

The need for accurate information from the upper atmosphere calls for direct measurements; this can only be done by sending instruments into the region that is being explored. Rockets and satellites are devices that permit man to send his instruments into the high regions of the atmosphere.

Rockets have already been successfully used to study the outer atmosphere. Certain solar radiations, for example, which are absorbed by the atmosphere and hence never reach the earth's surface, have been investigated.

The importance of rocket measurements is threefold: first, they provide direct measurements of events in the high atmosphere; second, these direct measurements permit us to upgrade the indirect data collected more economically from many ground stations, greatly increasing its value; and, third, new discoveries are possible—like the discovery of X rays in the ionosphere.

A variety of studies will be undertaken in the U. S. rocket program. Investigation of the structure of the atmosphere will include measurements of pressure, temperature, density, and winds. Special instruments will be used to measure the chemical and ionic composition of the atmosphere. Particles and radiations from the sun will be observed and measured. Variations in the nature of the ionosphere will provide information on the electrical currents which are flowing in the lower ionosphere.

Some 200 rockets will be launched, including Aerobees that reach an altitude of about 200 miles and Rockoons that travel some 60 miles above the earth. Most of the Aerobees will be fired from Fort Churchill in cooperation with Canada, and some from White Sands and Alamogordo, New Mexico. Rockoons will be launched from shipboard in many areas, including waters off the Antarctic coastline, off the west coast of North America, in equatorial regions, and in Arctic waters.

While rockets provide crucial information about the upper atmosphere, rockets have two limitations. First, their total flight is extremely short, while the time spent in a particular altitude range

is even shorter; and second, rocket coverage is limited to a small part of the earth. Thus, in spite of the great value of rocket data, much of which can be obtained only by rockets, there is a need for a tool which can provide data over a long period of time, over considerable heights above the earth, and over large expanses of the atmosphere about the earth.

A satellite can achieve these objectives, and for these reasons several international bodies strongly urged inclusion of satellites in the IGY effort. The satellite, in effect, represents an extension of rockets and provides a semi-permanent laboratory in the upper atmosphere.

There are two types of experiments that can be performed with an earth satellite. The first group relates to observations, measurements, and calculations which can be made from ground stations, observations of air density, the composition of the earth's crust, and geodetic determinations. In the second group are the direct measurement of events above the earth's masking atmosphere. These experiments will employ instruments within the satellite itself which will radio these observations of temperature, pressures, meteoritic particles, ultraviolet radiation, and cosmic rays to ground stations.

The world's geophysicists are working toward two goals in the International Geophysical Year: an increased mastery of the universe and the advancement of knowledge. There are many direct and obvious contributions that increased knowledge will make toward determining climatic trends and bettering our long-range weather forecasting, toward determining the amount of ice that presently exists and whether it is growing or shrinking, toward improving long-distance radio communication. These are just a sampling of the practical, everyday things with which IGY scientists are concerned, and the results of their observations will affect the daily life of everyone, both during IGY and in the future.

But in addition to these practical effects, there are other less practical but perhaps more important benefits in the advancement of knowledge through basic research. Too much of our current knowledge of the universe is theory. What we are in the process of doing is testing our theories. The success that we anticipate will be a success for humanity and it will serve as well as a starting point for new theories. We are engaged in the greatest scientific study of the earth and its surrounding elements that the world has even seen. Our theme is knowledge.

Book Reviews

Compton's Pictured Encyclopedia. 15 Volumes. Prices (depending upon binding) $104.50 to $139.50; school, library, and professional discounts. F. E. Compton & Co., Chicago. 1957 Edition.

The editors of *Compton's* have produced an encyclopedia which is compatible with modern educational theory. With the accent in the modern curriculum on research-type activities, problem solving, library research, and self-initiated activities by students, it is imperative that adequate reference materials be available. Certainly the student preparing for a panel presentation or a report, or who is seeking help on some problem would be likely to find pertinent information in *Compton's Pictured Encyclopedia.* This series will make an effective contribution to the need of teachers to find materials adaptable to the varied interests, abilities, and ages of students in their classes.

Illustrations of high quality are used profusely throughout the series. The illustrations include a variety of different kinds of maps, pictures in black and white and in color, bar and line graphs and picture graphs, and line drawings. Informative captions and a line or two of explanation accompany a majority of the illustrations used. The graphic representations are in color and are effectively presented.

The Fact-Index presented at the end of each volume is a special feature of the encyclopedia. Through the use of this device, one can readily locate information pertinent to the particular topic at hand in any of the books of the entire series. As an illustration of this, one may take the heading *Magnets* in the fact index for the "M" volume and discover that there are more than 25 references to related materials pertaining to magnets or magnetism in other volumes of the series. The page and volume of the related information are given. In addition, 96 Reference-Outlines are provided on subjects as varied as *Astronomy* and *World War II.* These should prove valuable in showing relationships, in assigning committee work, and in other ways. The "Here and There" and "Interest-Questions" featured at the beginning of each volume should do much to prod the interest of the academic laggard and to further stimulate the curiosity of the budding young genius.

The science teacher who is looking for enrichment materials will find many excellent possibilities. The opportunities to provide experience in library research activities are plentiful. Although valuable in any school setting, small schools with extremely limited library resources will find a set of *Compton's* invaluable. The many fascinating pictures and stories should do much to kindle the interests and imagination of students in both vocational and avocational directions.

A large number of "pure science" articles appear. These include excellent treatments of such topics as the following: magnets, atoms, plants, astronomy, chemistry, and electricity. Of equal or greater significance are the large number of articles devoted to scientific applications of one form or another, such as those on machines and automation. The books themselves do an effective job of integrating scientific, social, and historical material in a good many of the articles. They effectively present science in its relationship to the entire range of human activities both in the current and in the historical setting.

A copy of "Compton's at Work in the Classroom" is available to every teacher who has access to the series. Although teachers may desire to develop their own specific plans, the book should be suggestive and especially valuable to teachers in teaching science in the elementary school. Sample units have been developed at the elementary and secondary levels. These, too, are suggestive and indicate that here are valuable tools for the creative teacher to use in combination with direct experiences in demonstration, laboratory field trip, or science fair.

In summary, one might pay the series this tribute: These books are interesting. They are so well written, so beautifully illustrated, and so up to date in their treatment of topics, that busy parents, teachers, and students are likely to lay them aside with reluctance when they are called upon to focus their attention elsewhere.

Herbert A. Smith
Director, Bureau of Educational Research and Service
University of Kansas, Lawrence

Living Chemistry. Maurice R. Ahrens, Norris F. Bush, and Ray K. Easley. 582p. $5.28. Ginn and Co., Boston. 1957 (Second Revised Edition).

The authors are to be commended for their courage in attempting an entirely new approach designed to increase registration in high school chemistry, especially since there are limited areas where more than $5 will be paid for a high school text.

The book will certainly appeal to students for whom the high school course in chemistry is terminal. For this group, enough theory has been presented for understanding the applications and impact of chemistry on modern living. The material is current, in problem form, beautifully and profusely illustrated, and broad enough to appeal to diverse interests. Considerable source material for both teachers and pupils has also been provided.

For the college preparatory student, however, the usefulness of this text is limited. Although attempts at major generalizations have been made, there is no central, unifying, systematic theme in Part I, "Fundamentals of Chemistry." The periodic table has been relegated to a minor place in the appendix. There is little or no mention of equilibrium, chemical bonding, and principles of reaction. Hence, the study of these "fundamentals" will require much memorization of detail.

In the organization of this text, the authors may have

attempted to fire at too many targets. It is questionable as to how many direct hits will be made.

SAUL L. GEFFNER
Chairman, Science Dept.
Forest Hills, New York, High School

AMERICA'S NATURAL RESOURCES. Edited by Charles H. Callison. 211p. $3.75. The Ronald Press Co., New York. 1957.

Certainly a book such as this, with its depth of thought and its realistic approach to solutions, should be a handbook for all teachers as well as for all others who have even the remotest interest in the conservation movement. Its heart is a series of chapters devoted to the specific problems of soil, water, grasslands, forests, wildlife, fish, parks and wilderness, and land use—each written by an authority in the field. These are neatly prefaced by an ecological approach to conservation and the relationship of human populations to renewable resources, then forcefully climaxed by a suggested "Natural Resources Policy."

Despite the variety of topics discussed, the conclusions drawn by the contributors bear a remarkably common train of thought—namely, that while the work of local, state, and federal agencies is effective insofar as it goes, a greater correlation of effort is required and that much of the ultimate success of conservation rests with the individual citizen's ability to understand and practice its principles.

J. RICHARD SENTMAN
Science Teacher
Brocton, New York, Central School

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use. A soap containing excessive amounts of water-insoluble matter is from the economic viewpoint a poor buy.

If the instructor prefers, soaps with added impurities may be furnished the students in the form of unknowns. At Brooklyn College, for a three-hour laboratory period, students do one determination of a commercial soap followed by an unknown. These unknowns are prepared by deliberately adding impurities in the form of about two per cent of sodium hydroxide, sodium carbonate, starch, lanolin, tri-sodium phosphate, or pumice in various combinations.

This is done by covering some shaved soap (or flake soap) with ethanol in varying amounts. As a starting procedure, completely cover a quantity of the soap with alcohol in a stoppered bottle. Heat in a water bath. The soap softens and disperses in the alcohol at which time the other substances are added with constant stirring. The soap is shaken from time to time during the cooling period which follows until it congeals. The more alcohol added, the easier the soap is to work and of course the higher will be the per cent of moisture in the sample.

Audio-Visual REVIEWS

LANDS AND WATERS OF OUR EARTH. 11 min. sound, 1957. B & W, Color. Coronet Instructional Films, Coronet Bldg., Chicago 1, Ill.

Recommendation: Especially suitable for primary grades.

Content: Using a simple method of development, the film translates geographic terms into clearly illustrated ideas children can grasp. Book illustrations of land and water forms are followed by photographs of the actual lands and waters.

Evaluation: Well organized content and a slow, clear commentary which is effective with children. This is a good film for use in science study. A teacher's guide is included.

◊ ◊ ◊

FIREHOUSE DOG. Sound. $50 B & W, $100 Color. Film Associates, 10521 Santa Monica Blvd., Los Angeles 25, Calif.

Recommendation: First through third grades.

Content: This is an entertainingly told story of the Santa Monica City Fire Department's dog.

Evaluation: Good commentary, sound, and photography. A teacher's guide comes with the film.

◊ ◊ ◊

UNDERSTANDING OUR EARTH: HOW ITS SURFACE CHANGES. Sound, 1956. B & W, Color. Coronet Instructional Films, Coronet Bldg., Chicago 1, Ill.

Recommendation: Elementary and junior high school levels in general science and geology.

Content: The film shows how the earth's surface is constantly being changed by the two types of erosion, by wind and water, and also by volcanoes. It first depicts water and wind at work on a mound of soil, then shows how the forces of erosion act in a similar manner on mountains and large land forms.

Evaluation: Very good commentary and photography. A teacher's guide accompanies the film.

◊ ◊ ◊

EGGS TO CHICKENS. 10 min. sound, 1953. B & W, Color. Bailey Films, Inc., 6509 De Longpre Ave., Hollywood 28, Calif.

Recommendation: Sixth to ninth grades.

Content: Two children visit a chicken ranch with their friend Bob. In reply to their question, "Why don't some eggs hatch?" Bob explains the anatomy of a hen (shown on the screen by animated diagrams) and how eggs are fertilized, laid, and later incubated. Various sequences of the film show incubation, hatching, and egg ranching in general.

Evaluation: Good presentation of the anatomy of the hen and the development of the chick. The film is interesting but has one seeming discrepancy. As it opens, the viewer has the distinct impression—from the scenes and commentary—that this is a film for primary grade levels. Soon, however, certain things indicate that it is more suitable for older children with some maturity. Those things include the explanation of why some eggs do not hatch, the animated drawings, and the use of words such as *ovary, cell, embryo,* and *fertile.* In general, the commentary seems to be geared to the age level of the children pictured rather than the level of the concepts presented.

For Your Fall Calendar: The Central Association of Science and Mathematics Teachers has scheduled its annual convention this year on November 29 and 30 in Chicago, Illinois. The theme is "Expanding Horizons in Teaching Science and Mathematics," and the program will include discussions on atomic energy and its many applications and implications for the teacher. Developing a new framework for the convention program, its planners have scheduled tours, including one to the Argonne National Laboratories, distinguished speakers, and section meetings for demonstrations and experiments. For details about the program and additional information, write to Louis Panush, Vice-president, CASMT, Northeastern High School, Detroit, Michigan.

HETLAND—continued from page 173

2. The rate of evaporation also depends on the movement of air.
3. Heat will continually transfer from one substance to another until equilibrium is reached; i.e., both substances have the same temperature.
4. Solid, liquid, and gaseous forms of most substances are determined by the amount of heat present in a given amount of the substance; e.g., ice plus heat results in water, water plus heat in water vapor, water vapor minus heat in water, and water minus heat in ice.
5. More volatile substances evaporate faster than less volatile substances.

Also with these concepts students are better able to understand the why's of such things as refrigeration, weather, air conditioning, and many others. In fact, students can be asked to make reports explaining the function of such things as: refrigerators, automobile cooling systems and heaters, heat pumps, why is unpopped popcorn packaged in air-tight containers and what happens when it pops, why does a cold front usually cause rain to fall, why do some orange growers turn on their sprinkler systems on cold nights, and so forth. All of these can be explained by using the concepts just learned.

Examining the Practice in Relation to Principles of Learning

Let's examine for a moment some of the key principles of learning implicit in this inductive procedure just illustrated. We start with students where they are in their development and build on experiences they have had. We involve the students in problems, the answers to which are not known. We provide opportunity for additional experience necessary to discovering answers and new concepts. Through questioning and discussion we help students relate their known experience to the unknown. We use reading materials as another resource of information that may help them in their quest for answers. We continually encourage students to *think,* to be *active,* not passive, participants. We share their enthusiasm for the insights they have gained. And finally we have been reasonably true to the scientific method; i.e., at no time have we injected the element of its-so-because-I-say-so-or-the-textbook-says-so.

Comparing the Procedure with the Scientific Method

Have we made use of the scientific method? In part, yes, but we have not followed it strictly; e.g., the students did hypothesize, but they did not design tests for these hypotheses. This was done by the teacher for the reason that those inexperienced in the scientific method and lacking certain concepts will likely find the procedure difficult and confusing at first. For this reason the teacher would do well to review the entire proceedings step by step with the students so that the design of the method is clarified for them. Our emphasis in this situation was to raise questions and provide data which could be used to determine cause and effect relationships. On subsequent occasions the students should be involved more fully in designing experiments to test their hypotheses.

Raising One More Question

Some teachers believe strongly that principles of science are best developed in the abstract and then studied in operation. Others believe with equal intensity that science instruction should have a social context of some kind; i.e., a social context out of which the specific scientific question arises. While I personally believe there is much evidence to indicate a need for greater use of the social context approach, the purpose at this point is not to debate this question. Rather it is to raise another: since the inductive development of concepts is not patented or restricted to either approach, shouldn't anyone feel free to try it?

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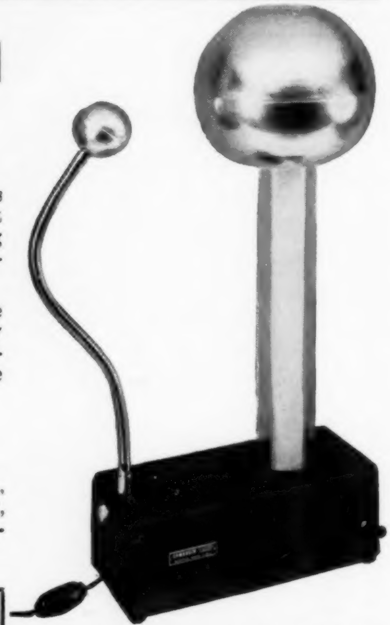

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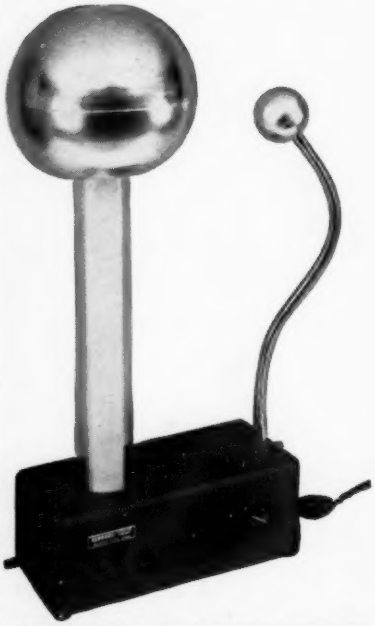

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